2.1.6 Traffic and Transportation/Pedestrian and Bicycle Facilities

This section addresses the potential effects to traffic and circulation associated with construction of the proposed project and compares the relative benefits of each alternative. The traffic circulation analysis is based on the results of the *Interstate 405 Improvements Project from Interstate 5 to State Route 55 Traffic Study* (January 2017) (Traffic Study). The Traffic Study evaluates the existing and future traffic flow conditions within the traffic study area within Orange County (defined below in Section 2.1.6.2, Affected Environment).

The Traffic Study evaluations included freeway mainline analysis, weaving analysis, and ramp junction analysis. The mainline freeway segments between ramps were analyzed using either the basic freeway segment or weaving analysis, as appropriate.

Basic freeway segments are characterized by various performance measures, including density in terms of passengers per mile per lane (pc/mi/ln), average speed, and volume to capacity (v/c) or demand volume-to-capacity (d/c) ratio. Each of these measures is an indication of how well traffic flow is being accommodated by the freeway.

Freeway Mainline Analysis

The freeway mainline analysis is based on the Highway Capacity Manual (HCM) 2010 basic Freeway Segment analysis method. Each freeway mainline segment evaluation is based on directional traffic volumes during the AM and PM peak hours. LOS of the basic freeway segment is determined by comparing the pc/mi/ln to the established density ranges for LOS A through F. Table 2.1.6-1 illustrates the freeway segment LOS thresholds for each density range utilized for this analysis and pursuant to the HCM.

Table 2.1.6-1. Freeway Segment LOS based on Density

LOS	Density Range (pc/mi/ln)	Description
A	0.0 – 11.0	Free-flow operations. Vehicles are almost completely unimpeded in their ability to maneuver within the traffic stream.
B	11.1 – 18.0	Reasonably free flow, and free-flow speeds are maintained. The ability to maneuver within the traffic stream is only slightly restricted.
C	18.1 – 26.0	Flow with speeds at or near the free-flow speed of the freeway. Freedom to maneuver within the traffic stream is noticeably restricted. Queues may be expected to form behind any significant blockage.
D	26.1 – 35.0	Speeds begin to decline slightly with increasing flows, and freedom to maneuver within the traffic stream is more noticeably limited.

Table 2.1.6-1. Freeway Segment LOS based on Density

LOS	Density Range (pc/mi/ln)	Description
E	35.1 – 45.0	Operation at capacity. Maneuverability within the traffic stream is extremely limited, and any incident can be expected to produce a serious breakdown with extensive queuing.
F	>45.0	Breakdowns in vehicular flow. Greater number of vehicles arriving than the number of vehicles discharged.

Source: Parsons, 2017.

High-Occupancy Vehicle Lane Analysis

The HCM does not have an explicit methodology to evaluate single-lane HOV operations. Because no HCM method is available, v/c ratios are calculated for HOV lanes to determine LOS. Based on the *High-Occupancy Vehicle Guidelines for Planning, Design, and Operation* prepared by Caltrans (August 2003), the HOV lane capacity utilized for this analysis is 2,200 vehicles per hour per lane (vphpl). The v/c ratios used to identify HOV lane LOS are summarized in Table 2.1.6-2.

Table 2.1.6-2. HOV LOS based on Volume to Capacity

LOS	V/C Ratio
A	≤ 0.32
B	0.33 – 0.53
C	0.54 – 0.74
D	0.75 – 0.90
E	0.91 – 1.00
F	> 1.00

Source: Caltrans, 2003.

Ramp-Freeway Junction Analysis

Ramps and ramp-freeway junction operation analyses (merges and diverges) are also based on HCM 2010, specifically the HCM merge, diverge, and/or weave analysis methodologies.

LOS in merge and diverge influence areas is determined by density for all cases of stable operation, represented by LOS A through E. LOS F exists when capacity is exceeded by demand. For on-ramps, LOS F exists when the total demand flow rate from the upstream freeway segment and the on-ramp exceeds capacity of the downstream freeway segment.

Intersection/Arterial Level of Service Analysis

The analysis methodology utilized to analyze intersections within the Caltrans jurisdiction is based on the methodologies described in HCM 2010 and summarized in Table 2.1.6-3.

Table 2.1.6-3. HCM 2010 Intersection LOS Criteria

LOS	Average Control Delay per Vehicle (seconds)	
	Type of Intersection Control	
	Signalized	Unsignalized/Stop Controlled
A	< 10	< 10
B	> 10 and < 20	> 10 and < 15
C	> 20 and < 35	> 15 and < 25
D	> 35 and < 55	> 25 and < 35
E	> 55 and < 80	> 35 and < 50
F	> 80	> 50

Source: HCM (2010: Exhibits 18-4 and 19-1).

A criterion of an increase of 0.04 or more in the overall v/c ratios is used to identify potential significant traffic impacts of the project to the intersections located within the Caltrans jurisdiction.

For intersections under jurisdiction of the City of Irvine, existing and future condition intersection LOS analysis is calculated using the Intersection Capacity Utilization (ICU) method based on the *City of Irvine Traffic Impact Analysis Guidelines* (August 2004), as summarized in Table 2.1.6-4. The lane capacity used in the ICU calculations is 1,700 vph.

Table 2.1.6-4. City of Irvine LOS Criteria

LOS	Volume-to-Capacity Ratio
A	0.00 – 0.60
B	0.61 – 0.70
C	0.71 – 0.80
D	0.81 – 0.90
E	0.91 – 1.00
F	Greater than 1.00

Source: City of Irvine Traffic Impact Analysis Guidelines (Pages 12 and 13).

Arterial segment LOS was conducted for segment locations owned by the City of Irvine (Table 2.1.6-6). The arterial segment LOS analysis is determined by comparing the ADT to the

maximum ADT for the acceptable LOS. The arterial segment analysis compares the ADT volumes to the maximum ADT for the acceptable LOS included in the *City of Irvine Traffic Impact Analysis Guidelines*, as summarized in Table 2.1.6-5. The maximum ADT for the acceptable LOS are determined based on the facility type for each arterial segment included in the *City of Irvine General Plan Circulation Exhibit B-1*. The peak-hour capacity is determined by multiplying the mid-block number of lanes for each direction by a lane capacity of 1,600 per hour. A significant traffic impact at an intersection and at an arterial segment occurs when either the project increases the v/c ratio by greater than 0.02 under acceptable LOS in the future no-build condition or operates at an acceptable LOS in the future no-build condition and the project results in the LOS not being acceptable.

Table 2.1.6-5. City of Irvine Maximum Daily Traffic Volumes for LOS D and E by Facility Type

Facility Type	Number of Lanes	Maximum ADT	
		LOS D	LOS E
Major Highway	8 Lanes	64,800	72,000
	6 Lanes	48,600	54,000
Primary Highway	4 Lanes	28,800	32,000
Secondary Highway	4 Lanes	25,200	28,000

Source: City of Irvine Traffic Impact Analysis Guidelines.

The analyses were conducted for the following traffic conditions:

- Existing Traffic Conditions – Year 2015
- Opening Year 2030 Alternative 1 (No Build)
- Opening Year 2030 Alternative 2
- Opening Year 2030 Alternative 3
- Design Year 2050 Alternative 1 (No Build)
- Design Year 2050 Alternative 2
- Design Year 2050 Alternative 3

2.1.6.1 Regulatory Setting

Caltrans, as assigned by FHWA, directs that full consideration should be given to the safe accommodation of pedestrians and bicyclists during the development of federal-aid highway projects (see 23 CFR 652). It further directs that the special needs of the elderly and the

disabled must be considered in all federal-aid projects that include pedestrian facilities. When current or anticipated pedestrian and/or bicycle traffic presents a potential conflict with motor vehicle traffic, every effort must be made to minimize the detrimental effects on all highway users who share the facility.

In July 1999, the U.S. Department of Transportation (USDOT) issued an Accessibility Policy Statement pledging a fully accessible multimodal transportation system. Accessibility in federally assisted programs is governed by the USDOT regulations (49 CFR Part 27) implementing Section 504 of the Rehabilitation Act (29 U.S.C. 794). FHWA has enacted regulations for implementation of the 1990 Americans with Disabilities Act (ADA), including a commitment to build transportation facilities that provide equal access for all persons. These regulations require application of the ADA requirements to federal-aid projects, including Transportation Enhancement Activities.

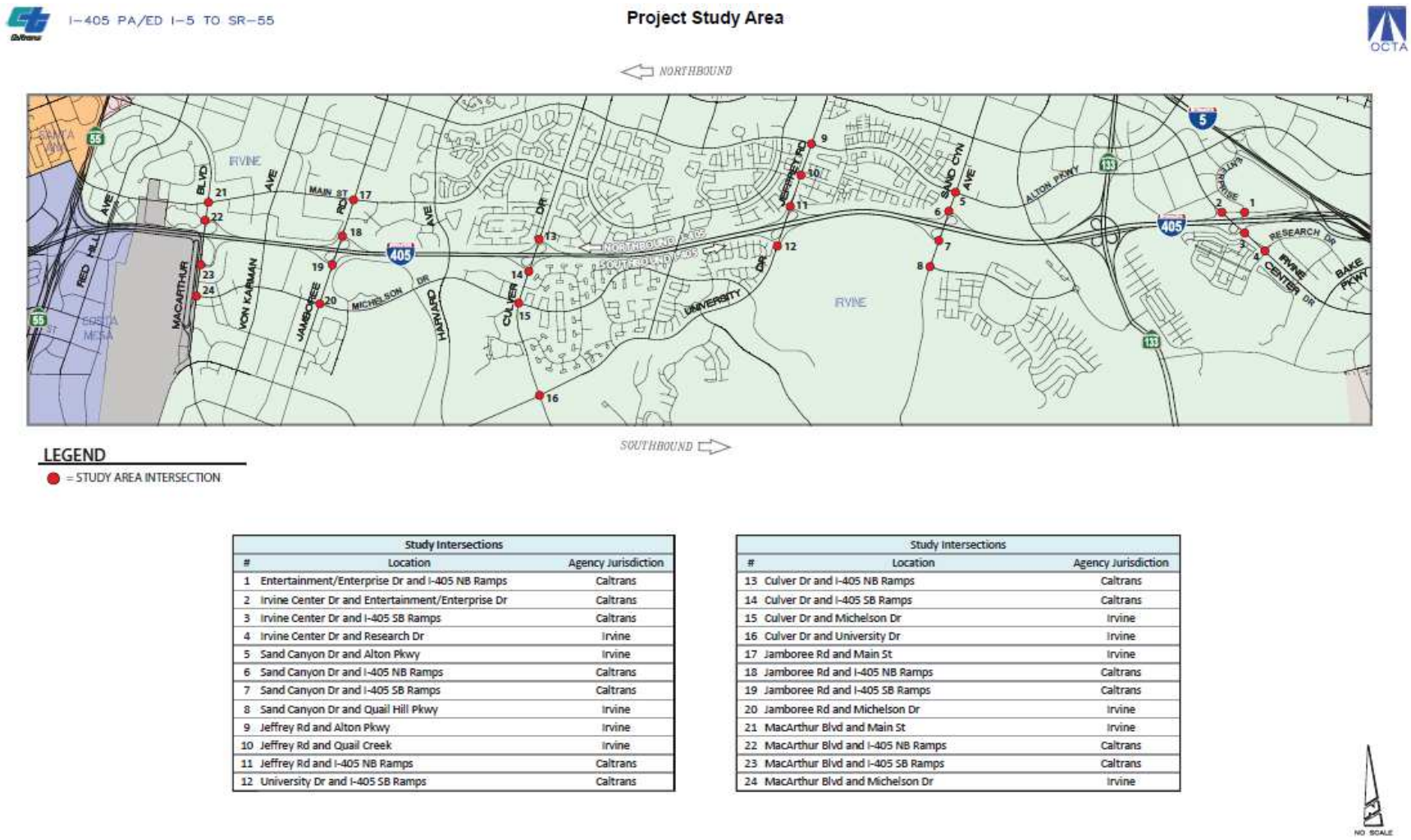
2.1.6.2 Affected Environment

The existing lane configuration, traffic volumes, LOS, and other operational characteristics within the traffic study area are presented in this subsection which has been prepared based on the analysis and findings presented in the *Traffic Study* (January 2017).

Traffic Study Area

The traffic study area, as shown in Figure 2.1.6-1, focuses on traffic operations of the I-405 corridor between I-5 and SR-55 and at some interchanges, including freeway ramps at their intersections with arterials, other arterial intersections that are in the immediate vicinity and have a direct bearing on freeway interchange traffic operations, and arterial segments in the immediate vicinity of interchanges. The proposed project covers approximately 8.5 miles along I-405 in the cities of Irvine, Costa Mesa, and a small portion of unincorporated Orange County.

For the purposes of traffic analysis, the I-405 freeway mainline has been divided into 20 NB and 19 SB freeway segments. The study intersections are shown and listed in Figure 2.1.6-1. Table 2.1.6-6 provides a list of the City of Irvine arterial study segments. It should be noted that the segment analysis is only applied for segments owned by the City of Irvine. As such, segment locations within the Caltrans ROW were not included in the analysis.



Study Intersections		
#	Location	Agency Jurisdiction
1	Entertainment/Enterprise Dr and I-405 NB Ramps	Caltrans
2	Irvine Center Dr and Entertainment/Enterprise Dr	Caltrans
3	Irvine Center Dr and I-405 SB Ramps	Caltrans
4	Irvine Center Dr and Research Dr	Irvine
5	Sand Canyon Dr and Alton Pkwy	Irvine
6	Sand Canyon Dr and I-405 NB Ramps	Caltrans
7	Sand Canyon Dr and I-405 SB Ramps	Caltrans
8	Sand Canyon Dr and Quail Hill Pkwy	Irvine
9	Jeffrey Rd and Alton Pkwy	Irvine
10	Jeffrey Rd and Quail Creek	Irvine
11	Jeffrey Rd and I-405 NB Ramps	Caltrans
12	University Dr and I-405 SB Ramps	Caltrans

Study Intersections		
#	Location	Agency Jurisdiction
13	Culver Dr and I-405 NB Ramps	Caltrans
14	Culver Dr and I-405 SB Ramps	Caltrans
15	Culver Dr and Michelson Dr	Irvine
16	Culver Dr and University Dr	Irvine
17	Jamboree Rd and Main St	Irvine
18	Jamboree Rd and I-405 NB Ramps	Caltrans
19	Jamboree Rd and I-405 SB Ramps	Caltrans
20	Jamboree Rd and Michelson Dr	Irvine
21	MacArthur Blvd and Main St	Irvine
22	MacArthur Blvd and I-405 NB Ramps	Caltrans
23	MacArthur Blvd and I-405 SB Ramps	Caltrans
24	MacArthur Blvd and Michelson Dr	Irvine

NO SCALE

Figure 2.1.6-1. Traffic Study Area

Table 2.1.6-6. City of Irvine Arterial Study Segment Locations

#	Locations	Facility Type
1	Irvine Center Drive between I-405 SB ramps and Research Drive	Major Highway – 6 Lanes
2	Sand Canyon Avenue between Alton Parkway and I-405 NB ramps	Major Highway – 6 Lanes
3	Sand Canyon Avenue between I-405 SB ramps and Quail Hill Parkway	Major Highway – 6 Lanes
4	Alton Parkway between Jeffrey Road and Sand Canyon Avenue	Primary Highway
5	Jeffrey Road between Alton Parkway and Quail Creek	Major Highway – 6 Lanes
6	Jeffrey Road between Quail Creek and I-405 NB ramps	Major Highway – 6 Lanes
7	University Drive between I-405 SB ramps and Michelson Drive	Major Highway – 6 Lanes
8	University Drive between Yale Avenue and Culver Drive	Primary Highway
9	Culver Drive between I-405 SB ramps and Michelson Drive	Major Highway – 6 Lanes
10	Culver Drive between Michelson Drive and Sandburg Way	Major Highway – 6 Lanes
11	Culver Drive between Sandburg Way and University Drive	Major Highway – 6 Lanes
12	Jamboree Road between Main Street and I-405 NB ramps	Major Highway – 8 Lanes
13	Jamboree Road between I-405 SB ramps and Michelson Drive	Major Highway – 8 Lanes
14	MacArthur Boulevard between Main Street and I-405 NB ramps	Major Highway – 8 Lanes
15	MacArthur Boulevard between I-405 SB ramps and Michelson Drive	Major Highway – 8 Lanes

Source: Traffic Study, 2017.

Currently, the I-405 freeway mainline in the NB direction consists of five GP lanes with auxiliary lanes in some segments between I-5 and SR-133 and between Culver Drive and SR-55. For the freeway mainline between SR-133 and Culver Drive, the freeway mainline consists of four GP lanes with auxiliary lanes in some segments. In the SB direction, the freeway mainline consists of five GP lanes with auxiliary lanes in some segments between SR-55 and Culver Drive. For the freeway mainline between Culver Drive and Lake Forest Drive, the freeway mainline consists of four GP lanes with auxiliary lanes in some segments and three GP lanes south of the Lake Forest Drive exit ramp. The freeway mainline also includes one HOV lane in each direction from I-5 to SR-55. Figures 2.1.6-2 and 2.1.6-3 provide schematic presentations of the existing (2015) conditions.

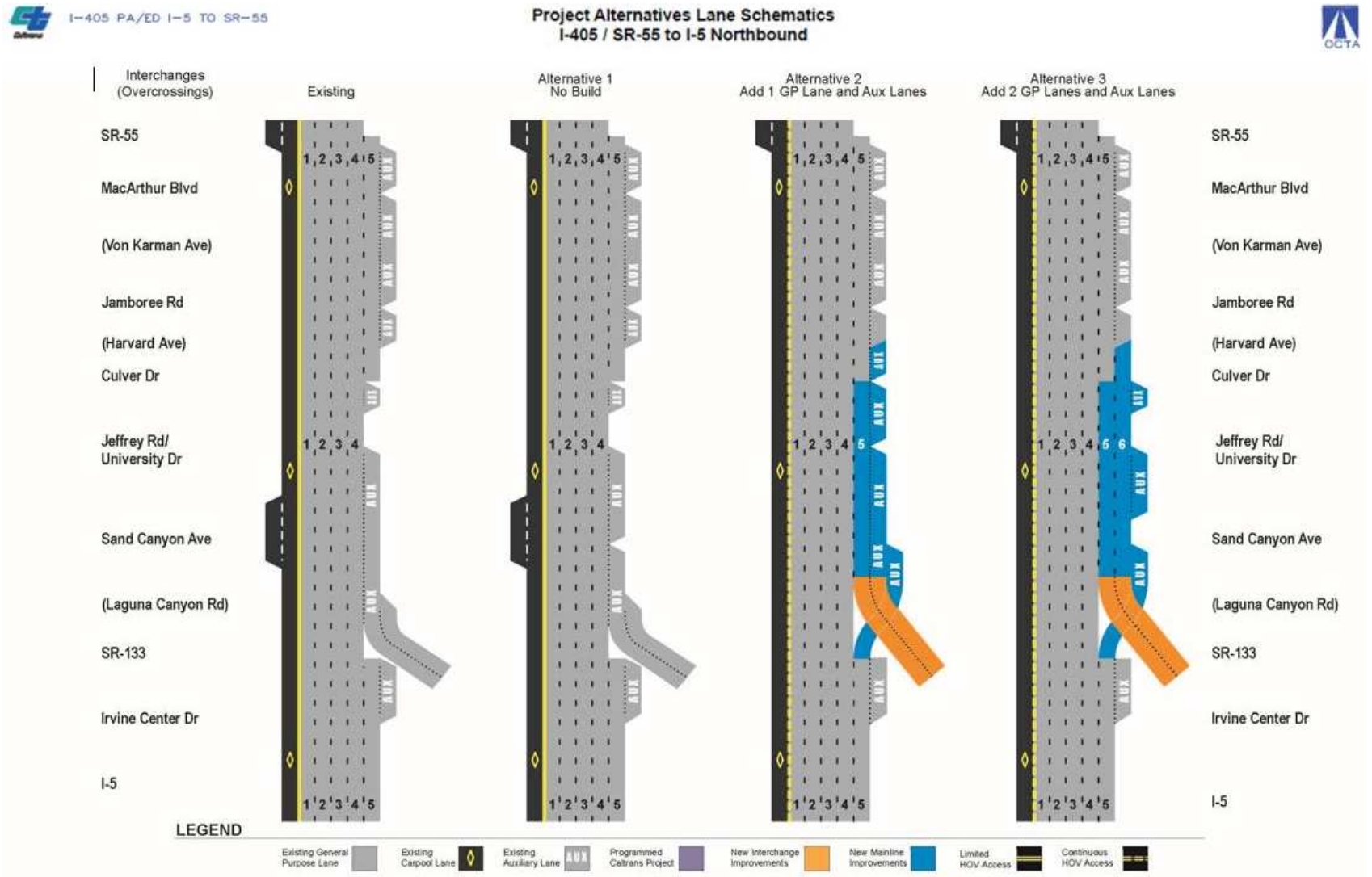


Figure 2.1.6-2. Project Alternatives Lane Schematics (Northbound)

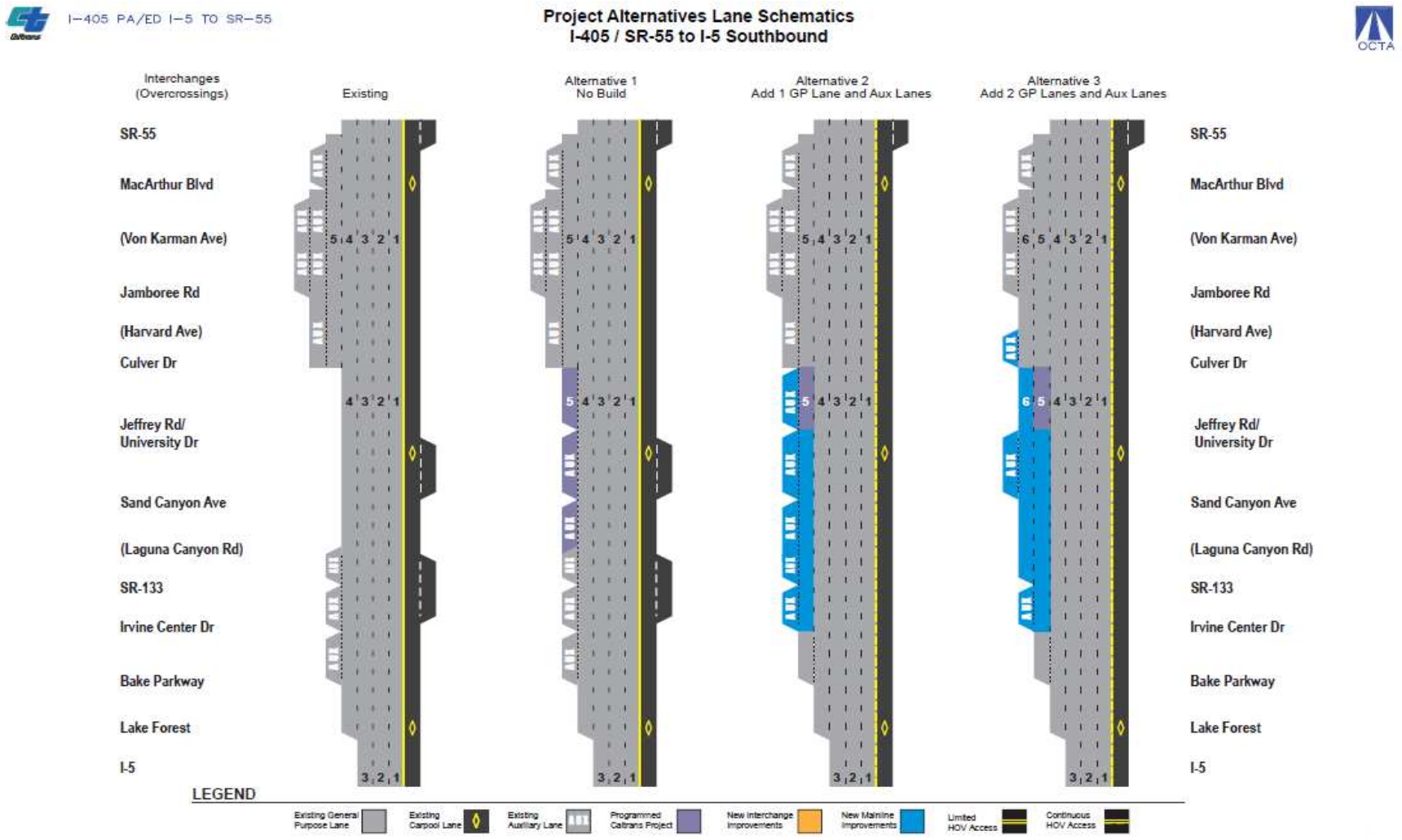


Figure 2.1.6-3. Project Alternatives Lane Schematics (Southbound)

Existing (Year 2015) Conditions Analysis

Freeway Component

Existing traffic volumes play a critical role in the overall analysis of infrastructure investments. Existing condition ADT volume is approximately 253,749. Weekday daily VMT within the study area is 2.0 million vehicle miles. Table 2.1.6-7 presents the LOS of each freeway segment. Under existing (2015) conditions, most of the GP lane segments operate at LOS F during the AM and PM peak hours in both directions. The following NB and SB segments operate at LOS F in the GP lanes during the AM or PM peak hours:

I-405 NB Segments

- Between Enterprise Drive on-ramp and Irvine Center Drive on-ramp (AM)
- Between Irvine Center Drive on-ramp and SR-133 SB off-ramp (AM)
- Between SR-133 SB off-ramp and SR-133 NB/SB on-ramps (AM)
- Between SR-133 NB/SB on-ramps and Sand Canyon Avenue off-ramp (AM and PM)
- Between Sand Canyon Avenue off-ramp and Sand Canyon Avenue loop on-ramp (AM and PM)
- Between Sand Canyon Avenue loop on-ramp and Sand Canyon Avenue direct on-ramp (AM)
- Between Sand Canyon Avenue direct on-ramp and Jeffrey Road off-ramp (AM)
- Between Jeffrey Road off-ramp and Jeffrey Road loop on-ramp (AM)
- Between Jeffrey Road loop on-ramp and Jeffrey Road direct on-ramp (AM)
- Between Culver Drive off-ramp and Culver Drive loop on-ramp (PM)
- Between Jamboree Road off-ramp and Jamboree Road loop on-ramp (PM)
- Between Jamboree Road loop on-ramp and Jamboree Road direct on-ramp (PM)
- Between Jamboree Road direct on-ramp and MacArthur Boulevard off-ramp (PM)
- Between MacArthur Boulevard off-ramp and MacArthur Boulevard on-ramp (PM)
- Between MacArthur Boulevard on-ramp and SR-55 NB/SB off-ramps (PM)

I-405 SB Segments

- Between SR-55 SB on-ramp and MacArthur Boulevard off-ramp (AM and PM)
- Between MacArthur Boulevard off-ramp and MacArthur Boulevard on-ramp (PM)
- Between MacArthur Boulevard on-ramp and Jamboree Road off-ramp (PM)
- Between Jamboree Road off-ramp and Jamboree Road loop on-ramp (PM)
- Between Jamboree Road loop on-ramp and Jamboree Road direct on-ramp (PM)

- Between Jamboree Road direct on-ramp and Culver Drive off-ramp (PM)
- Between Culver Drive off-ramp and Culver Drive loop on-ramp (AM and PM)
- Between Culver Drive loop on-ramp and Culver Drive direct on-ramp (AM and PM)
- Between Culver Drive direct on-ramp and University Drive off-ramp (AM and PM)
- Between University Drive off-ramp and University Drive loop on-ramp (AM and PM)
- Between University Drive loop on-ramp and University Drive direct on-ramp (AM and PM)
- Between University Drive direct on-ramp and Sand Canyon Avenue off-ramp (AM and PM)

HOV lane segments along I-405 within the project study area operate at LOS C or better during the AM and PM peak periods in both directions.

Table 2.1.6-7. Existing (Year 2015) Condition I-405 Freeway Mainline Segment Peak-Hour Level of Service

Segments	AM Peak Hour		PM Peak Hour	
	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]
Northbound				
Between Enterprise Drive off-ramp and truck bypass lane on-ramp	C	D	B	B
Between truck bypass lane on-ramp and Enterprise Drive on-ramp	C	C	B	B
Between Enterprise Drive on-ramp and Irvine Center Drive on-ramp	C	F	B	C
Between Irvine Center Drive on-ramp and SR-133 SB off-ramp	C	**F**	B	C
Between SR-133 SB off-ramp and SR-133 NB/SB on-ramps	C	**F**	B	D
Between SR-133 NB/SB on-ramps and Sand Canyon Avenue off-ramp	C	**F**	B	**F**
Between Sand Canyon Avenue off-ramp and Sand Canyon Avenue loop on-ramp	C	**F**	B	**F**
Between Sand Canyon Avenue loop on-ramp and Sand Canyon Avenue direct on-ramp	C	**F**	C	E
Between Sand Canyon Avenue direct on-ramp and Jeffrey Road off-ramp	C	**F**	C	E
Between Jeffrey Road off-ramp and Jeffrey Road loop on-ramp	C	**F**	C	E
Between Jeffrey Road loop on-ramp and Jeffrey Road direct on-ramp	C	**F**	C	E
Between Jeffrey Road direct on-ramp and Culver Drive off-ramp	C	D	C	D
Between Culver Drive off-ramp and Culver Drive loop on-ramp	C	E	C	**F**
Between Culver Drive loop on-ramp and Culver Drive direct on-ramp	C	D	C	D
Between Culver Drive direct on-ramp and Jamboree Road off-ramp	B	E	C	E
Between Jamboree Road off-ramp and Jamboree Road loop on-ramp	B	D	C	**F**
Between Jamboree Road loop on-ramp and Jamboree Road direct on-ramp	B	D	C	**F**

Table 2.1.6-7. Existing (Year 2015) Condition I-405 Freeway Mainline Segment Peak-Hour Level of Service

Segments	AM Peak Hour		PM Peak Hour	
	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]
Between Jamboree Road direct on-ramp and MacArthur Boulevard off-ramp	B	D	C	**F**
Between MacArthur Boulevard off-ramp and MacArthur Boulevard on-ramp	B	D	B	**F**
Between MacArthur Boulevard on-ramp and SR-55 NB/SB off-ramps	B	C	B	**F**
Southbound				
Between SR-55 SB on-ramp and MacArthur Boulevard off-ramp	C	**F**	B	**F**
Between MacArthur Boulevard off-ramp and MacArthur Boulevard on-ramp	C	E	C	**F**
Between MacArthur Boulevard on-ramp and Jamboree Road off-ramp	C	C	C	**F**
Between Jamboree Road off-ramp and Jamboree Road loop on-ramp	C	D	C	**F**
Between Jamboree Road loop on-ramp and Jamboree Road direct on-ramp	C	D	C	**F**
Between Jamboree Road direct on-ramp and Culver Drive off-ramp	C	E	C	**F**
Between Culver Drive off-ramp and Culver Drive loop on-ramp	C	**F**	C	**F**
Between Culver Drive loop on-ramp and Culver Drive direct on-ramp	C	**F**	C	**F**
Between Culver Drive direct on-ramp and University Drive off-ramp	B	**F**	C	**F**
Between University Drive off-ramp and University Drive loop on-ramp	B	**F**	C	**F**
Between University Drive loop on-ramp and University Drive direct on-ramp	B	**F**	C	**F**
Between University Drive direct on-ramp and Sand Canyon Avenue off-ramp	B	**F**	C	**F**
Between Sand Canyon Avenue off-ramp and Sand Canyon Avenue on-ramp	B	D	C	E
Between Sand Canyon Avenue on-ramp and SR-133 NB/SB off-ramps	B	D	C	E
Between SR-133 NB/SB off-ramps and SR-133 NB/SB on-ramps	A	D	B	D
Between SR-133 NB/SB on-ramps and Irvine Center Drive off-ramp	B	C	B	C
Between Irvine Center Drive off-ramp and Irvine Center Drive loop on-ramp	B	C	B	C
Between Irvine Center Drive loop on-ramp and Irvine Center Drive direct on-ramp	B	B	B	C
Between Irvine Center Drive direct on-ramp and Bake Parkway off-ramp	B	B	B	C

Notes:
(1) HOV Lane LOS: LOS is based on v/c ratio using a capacity of 2,200 vph.
(2) GP and Auxiliary (AUX) lanes LOS: LOS is based on density (pc/mil/ln).

Source: Traffic Study, 2017.

Ramp and Ramp-Freeway Junction

Under existing (2015) conditions, the NB ramp junction peak-hour LOS varies from A to D during the AM and PM peak hours with the following NB ramp junction locations operating at LOS F during either the AM or PM peak hour:

- Jeffrey Road/University Drive loop on-ramp (AM)
- Jamboree Road loop on-ramp (PM)

For the SB ramp junction locations, the following locations operate at LOS F during either the AM or PM peak hour:

- Jamboree Road loop on-ramp (PM)
- Jamboree Road direct on-ramp (PM)
- Culver Drive loop on-ramp (AM and PM)
- Culver Drive direct on-ramp (AM and PM)
- Jeffrey Road/University Drive direct off-ramp (AM and PM)
- Jeffrey Road/University Drive loop on-ramp (AM and PM)
- Jeffrey Road/University Drive direct on-ramp (AM and PM)
- Sand Canyon Avenue direct off-ramp (AM and PM)

Average Peak-Hour Speed, Vehicle Hours of Delay, and Cost of Delay

Table 2.1.6-8 provides a summary of existing average travel speeds along the I-405 corridor. The average travel speeds are provided for a full-length trip within the project limits from I-5 to SR-55, as well as for a trip within the area where the proposed build alternatives would provide additional GP lane(s) on the freeway mainline, based on the longest limits of additional GP lanes that occur in Alternative 3; in the NB direction, these limits are from SR-133 to Jamboree Road, and in the SB direction, the limits are from Culver Drive to Irvine Center Drive.

Table 2.1.6-8. Existing (Year 2015) I-405 Freeway Mainline Average Speed (mph)

Peak Hour	Within the Project Limits		Area of GP Lane Addition	
	HOV	GP	HOV	GP
Northbound				
AM	50	47	56	45
PM	61	44	63	46
Southbound				
AM	61	49	64	51
PM	56	38	60	45

Source: Traffic Study, 2017.

The average speeds for a full-length trip within the project limits from I-5 to SR-55 is 47 and 44 mph for the AM and PM peak hours, respectively. Average travel speeds in the NB HOV lane during AM and PM peak hours are 50 and 61 mph, respectively. The average speeds in the GP lanes on SB I-405 are 49 and 39 mph for the AM and PM peak hours, respectively. Average travel speeds in the SB HOV lane during AM and PM peak hours are 61 and 56 mph, respectively.

For a trip within the area where the proposed build alternatives would provide GP lanes, the average speeds in the GP lanes on NB I-405 are 45 and 46 mph for the AM and PM peak hours, respectively. Average travel speeds in the NB HOV lane during the AM and PM peak hours are 56 and 63 mph, respectively. Average travel speeds in the SB HOV lane during the AM and PM hours are 64 and 60 mph, respectively.

Cumulatively, there are approximately 6,300 vehicle hours of delay on I-405 within the study area on a typical weekday. On an annual basis, there are approximately 1.6 million vehicle hours of delay on I-405, amounting to an approximate $45 million annual cost of delay.

Interchanges

To establish existing traffic conditions at study area intersections, AM and PM peak-hour turning movement counts were collected at all study intersections. As shown in Figure 2.1.6-1, there are 13 intersections and 11 intersections under Caltrans and City of Irvine jurisdiction within the study area, respectively. A summary is provided in Table 2.1.6-9.

Table 2.1.6-9. Existing (Year 2015) Intersection Level of Service Summary

#	Intersection Location	LOS Criterion	Agency Jurisdiction	Caltrans HCM – 2010		City of Irvine – ICU	
				Peak-Hour LOS			
				AM	PM	AM	PM
1*	NB I-405/Fortune Drive (NS) & Entertainment/Enterprise Drive (EW)	*	Caltrans	C	D	—	—
2	Irvine Center Drive (NS) & Entertainment/Enterprise Drive (EW)	E	Caltrans	A	C	—	—
3	Irvine Center Drive (NS) & SB I-405 (EW)	E	Caltrans	B	B	—	—
4	Irvine Center Drive (NS) & Research Drive (EW)	D	Irvine	—	—	A	A
5	Sand Canyon Avenue (NS) & Alton Parkway (EW)	D	Irvine	—	—	B	B
6	Sand Canyon Avenue (NS) & NB I-405 (EW)	E	Caltrans	A	B	—	—
7	Sand Canyon Avenue (NS) & SB I-405 (EW)	E	Caltrans	D	C	—	—
8	Sand Canyon Avenue (NS) & Quail Hill Parkway (EW)	D	Irvine	A	A	—	—
9	Jeffrey Road (NS) & Alton Parkway (EW)	D	Irvine	—	—	D	C
10	Jeffrey Road (NS) & Quail Creek (EW)	D	Irvine	—	—	B	B
11	Jeffrey Road/University Drive (NS) & NB I-405 (EW)	E	Caltrans	B	C	—	—
12	Jeffrey Road/University Drive (NS) & SB I-405 (EW)	E	Caltrans	A	B	—	—
13	Culver Drive (NS) & NB I-405 (EW)	E	Caltrans	B	B	—	—
14	Culver Drive (NS) & SB I-405 (EW)	E	Caltrans	B	C	—	—
15	Culver Drive (NS) & Michelson Drive (EW)	D	Irvine	—	—	A	C
16	Culver Drive (NS) & University Drive (EW)	D	Irvine	—	—	C	D
17	Jamboree Road (NS) & Main Street (EW)	E	Irvine	—	—	C	D
18	Jamboree Road (NS) & NB I-405 (EW)	E	Caltrans	B	B	—	—
19	Jamboree Road (NS) & SB I-405 (EW)	E	Caltrans	E	B	—	—
20	Jamboree Road (NS) & Michelson Drive (EW)	E	Irvine	—	—	B	C
21	MacArthur Boulevard (NS) & Main Street (EW)	E	Irvine	—	—	A	C
22	MacArthur Boulevard (NS) & NB I-405 (EW)	E	Caltrans	B	B	—	—
23	MacArthur Boulevard (NS) & SB I-405 (EW)	E	Caltrans	C	C	—	—
24	MacArthur Boulevard (NS) & Michelson Drive (EW)	E	Irvine	—	—	B	D

Notes:
LOS – Level of Service; v/c – Volume-to-Capacity; d/c – Demand Volume-to-Capacity; (NS) – North-South Direction; (EW) – East-West Direction

* Entertainment/Enterprise Drive and Fortune Drive are not designated highway arterials; thus, the criteria defined in Section 2.1.6.2 does not apply to this intersection.

Source: Traffic Study, 2017.

All of the intersections are currently signalized except for the intersection of Sand Canyon Avenue and Quail Hill Parkway, which is a roundabout. The acceptable LOS for intersections under Caltrans is LOS E or better. The acceptable LOS for intersections under City of Irvine jurisdiction is LOS D or better, except for the following intersections where LOS E or better is acceptable:

- Jamboree Road and Main Street
- Jamboree Road and Michelson Drive
- MacArthur Boulevard and Main Street
- MacArthur Boulevard and Michelson Drive

As shown in Table 2.1.6-9 the existing condition at all study area intersections operates at acceptable levels per the requirements of their respective jurisdictions.

Arterials

A summary of the ADT volume comparison to the maximum ADT and the acceptable LOS for each segment is provided in Table 2.1.6-10.

Table 2.1.6-10. Existing (Year 2015) Arterial Segment Level of Service Summary

#	Arterial	From	To	LOS Criteria	Number of Lanes (Mid-Block)	LOS
1	Irvine Center Drive	I-405 SB ramps	Research Drive	D	7	<D
2	Sand Canyon Avenue	Alton Parkway	I-405 NB ramps	D	5	<D
3	Sand Canyon Avenue	I-405 SB ramps	Quail Hill Parkway	D	4	<D
4	Alton Parkway	Jeffrey Road	Sand Canyon Avenue	D	4	<D
5	Jeffrey Road	Alton Parkway	Quail Creek Road	D	6	>D
6	Jeffrey Road	Quail Creek Road	I-405 NB ramps	D	6	>D
7	University Drive	I-405 SB ramps	Michelson Drive	D	5	>D
8	University Drive	Yale Avenue	Culver Drive	D	4	>D
9	Culver Drive	I-405 SB ramps	Michelson Drive	D	6	>D
10	Culver Drive	Michelson Drive	Sandburg	D	6	<D
11	Culver Drive	Sandburg	University Drive	D	6	<D
12	Jamboree Road	Main Street	I-405 NB ramps	E	10	<E
13	Jamboree Road	I-405 SB ramps	Michelson Drive	E	10	<E

Table 2.1.6-10. Existing (Year 2015) Arterial Segment Level of Service Summary

#	Arterial	From	To	LOS Criteria	Number of Lanes (Mid-Block)	LOS
14	MacArthur Boulevard	Main Street	I-405 NB ramps	E	8	<E
15	MacArthur Boulevard	I-405 SB ramps	Michelson Drive	E	8	<E

Notes:
LOS – Level of Service

Source: Traffic Study, 2017.

The LOS acceptable for arterial segments owned by the City of Irvine is LOS D or better, except for the following segments where LOS E or better is acceptable:

- Jamboree Road between Main Street and NB I-405 ramps
- Jamboree Road between SB I-405 ramps and Michelson Drive
- MacArthur Boulevard between Main Street and NB I-405 ramps
- MacArthur Boulevard between SB I-405 ramps and Michelson Drive

As shown in Table 2.1.6-10, the existing condition segment analysis indicates that the following arterial segments do not meet the City of Irvine acceptable LOS:

- University Drive between SB I-405 ramps and Michelson Drive
- University Drive between Yale Avenue and Culver Drive
- Culver Drive between SB I-405 ramps and Michelson Drive

Pedestrian and Bicycle Facilities

The primary components of the pedestrian circulation system are sidewalks and crosswalks. Under existing conditions, most of the developed properties adjacent to the study area are improved with sidewalks.

The City of Irvine's Bikeways Map and OCTA's OC Bikeways Map show multiple bikeways that run above, below, or adjacent to the proposed project area, as listed below:

- Red Hill Avenue (Class II)
- Von Karman Avenue (Class II)

- San Diego Creek Trail (Class I)
- Harvard Avenue (Class II)
- Freeway Trail (Class I)
- Culver Drive (Class II)
- Yale Avenue (Class I)
- Jeffrey Road (Class II)
- University Trail (Class I)
- Sand Canyon Trail (Class II)
- Laguna Canyon Road (Class II)
- Irvine Center Drive (Class II)

Existing bike lanes and trails within the project limits would be maintained. Existing sidewalks within the project limits would also be maintained. Pedestrian facilities on arterials being improved would meet current ADA standards for sidewalks, access ramps, and crosswalks.

2.1.6.3 Environmental Consequences

Year 2030 is the year in which the proposed project is scheduled to be open to traffic if one of the build alternatives is implemented. Year 2050 is the design horizon year for the proposed project build alternatives. Therefore, traffic analyses were conducted for the following six future conditions:

- Existing Traffic Conditions – Year 2015
- Opening Year 2030 Alternative 1 – No Build
- Opening Year 2030 Alternative 2
- Opening Year 2030 Alternative 3
- Design Year 2050 Alternative 1 – No Build
- Design Year 2050 Alternative 2
- Design Year 2050 Alternative 3

Alternative 1 (No Build)

Alternative 1, the No Build Alternative, assumes that the I-405 corridor would not be widened except for fully funded projects that are currently programmed by Caltrans in the SHOPP, STIP, or CMIA. These include construction of a SB auxiliary lane between SR-133 and the Sand Canyon Avenue on-ramp, another between the Sand Canyon Avenue off-ramp and the

Jeffrey Road/University Drive on-ramp, and the extension of one SB lane between the University Drive off-ramp and the Culver Drive off-ramp. Alternative 1 ADT is forecast to be approximately 274,812 in 2030 and 291,184 in 2050. Weekday daily VMT on I-405 within the study area is forecast to be approximately 2.2 million vehicle miles in 2030 and 2.3 million vehicle miles in 2050 under Alternative 1.

Freeway Mainline

Under year 2030 and 2050 Alternative 1 conditions, most of the GP lane segments are expected to operate at LOS F during the AM and the PM peak hours in both directions, as shown in Table 2.1.6-11.

Table 2.1.6-11. Alternative 1 Opening Year 2030 and Design Year 2050 Condition I-405 Freeway Mainline Segment Peak-Hour Level of Service

Segments	Existing (Year 2015)				Opening Year 2030				Design Year 2050			
	AM		PM		AM		PM		AM		PM	
	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]
Northbound												
Between Enterprise Drive off-ramp and truck bypass lane on-ramp	C	D	B	B	C	D	B	B	C	D	B	C
Between truck bypass lane on-ramp and Enterprise Drive on-ramp	C	C	B	B	C	D	B	B	C	D	B	C
Between Enterprise Drive on-ramp and Irvine Center Drive on-ramp	C	**F**	B	C	C	**F**	B	C	C	**F**	B	C
Between Irvine Center Drive on-ramp and SR-133 SB off-ramp	C	**F**	B	C	C	**F**	B	D	C	**F**	B	D
Between SR-133 SB off-ramp and SR-133 NB/SB on-ramps	C	**F**	B	D	C	**F**	B	D	C	**F**	B	D
Between SR-133 NB/SB on-ramps and Sand Canyon Avenue off-ramp	C	**F**	B	**F**	C	**F**	B	**F**	C	**F**	B	**F**
Between Sand Canyon Avenue off-ramp and Sand Canyon Avenue loop on-ramp	C	**F**	B	**F**	C	**F**	B	**F**	C	**F**	B	**F**
Between Sand Canyon Avenue loop on-ramp and Sand Canyon Avenue direct on-ramp	C	**F**	C	E	D	**F**	C	**F**	D	**F**	C	**F**
Between Sand Canyon Avenue direct on-ramp and Jeffrey Road off-ramp	C	**F**	C	E	D	**F**	C	**F**	D	**F**	C	**F**
Between Jeffrey Road off-ramp and Jeffrey Road loop on-ramp	C	**F**	C	E	D	**F**	C	**F**	D	**F**	C	**F**

Table 2.1.6-11. Alternative 1 Opening Year 2030 and Design Year 2050 Condition I-405 Freeway Mainline Segment Peak-Hour Level of Service

Segments	Existing (Year 2015)				Opening Year 2030				Design Year 2050			
	AM		PM		AM		PM		AM		PM	
	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]
Between Jeffrey Road loop on-ramp and Jeffrey Road direct on-ramp	C	**F**	C	E	D	**F**	C	**F**	D	**F**	C	**F**
Between Jeffrey Road direct on-ramp and Culver Drive off-ramp	C	D	C	D	C	E	C	E	D	E	C	E
Between Culver Drive off-ramp and Culver Drive loop on-ramp	C	E	C	**F**	C	E	C	**F**	D	**F**	C	**F**
Between Culver Drive loop on-ramp and Culver Drive direct on-ramp	C	D	C	D	C	D	C	E	D	E	C	E
Between Culver Drive direct on-ramp and Jamboree Road off-ramp	B	E	C	E	B	E	C	**F**	B	E	C	**F**
Between Jamboree Road off-ramp and Jamboree Road loop on-ramp	B	D	C	**F**	B	D	C	**F**	B	E	C	**F**
Between Jamboree Road loop on-ramp and Jamboree Road direct on-ramp	B	D	C	**F**	B	D	C	**F**	B	E	C	**F**
Between Jamboree Road direct on-ramp and MacArthur Boulevard off-ramp	B	D	C	**F**	B	E	C	**F**	B	E	C	**F**
Between MacArthur Boulevard off-ramp and MacArthur Boulevard on-ramp	B	D	B	**F**	B	D	C	**F**	B	D	C	**F**
Between MacArthur Boulevard on-ramp and SR-55 NB/SB off-ramps	B	C	B	**F**	B	D	C	**F**	B	D	C	**F**
Southbound												
Between SR-55 SB on-ramp and MacArthur Boulevard off-ramp	C	**F**	B	**F**	C	**F**	B	E	C	**F**	C	**F**
Between MacArthur Boulevard off-ramp and MacArthur Boulevard on-ramp	C	E	C	**F**	C	**F**	C	D	C	**F**	C	E
Between MacArthur Boulevard on-ramp and Jamboree Road off-ramp	C	C	C	**F**	C	D	C	D	C	E	C	E
Between Jamboree Road off-ramp and Jamboree Road loop on-ramp	C	D	C	**F**	C	D	C	D	C	E	C	E
Between Jamboree Road loop on-ramp and Jamboree Road direct on-ramp	C	D	C	**F**	C	D	C	D	C	E	C	E
Between Jamboree Road direct on-ramp and Culver Drive off-ramp	C	E	C	**F**	C	E	C	D	C	**F**	C	E

Table 2.1.6-11. Alternative 1 Opening Year 2030 and Design Year 2050 Condition I-405 Freeway Mainline Segment Peak-Hour Level of Service

Segments	Existing (Year 2015)				Opening Year 2030				Design Year 2050			
	AM		PM		AM		PM		AM		PM	
	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]
Between Culver Drive off-ramp and Culver Drive loop on-ramp	C	**F**	C	**F**	C	**F**	C	E	C	**F**	C	**F**
Between Culver Drive loop on-ramp and Culver Drive direct on-ramp	C	**F**	C	**F**	C	**F**	C	E	C	**F**	C	**F**
Between Culver Drive direct on-ramp and University Drive off-ramp	B	**F**	C	**F**	C	E	C	E	C	E	C	E
Between University Drive off-ramp and University Drive loop on-ramp	B	**F**	C	**F**	C	**F**	C	**F**	C	**F**	C	**F**
Between University Drive loop on-ramp and University Drive direct on-ramp	B	**F**	C	**F**	C	**F**	C	**F**	C	**F**	C	**F**
Between University Drive direct on-ramp and Sand Canyon Avenue off-ramp	B	**F**	C	**F**	B	**F**	C	**F**	B	**F**	C	**F**
Between Sand Canyon Avenue off-ramp and Sand Canyon Avenue on-ramp	B	D	C	E	B	E	C	E	B	E	C	**F**
Between Sand Canyon Avenue on-ramp and SR-133 NB/SB off-ramps	B	D	C	E	B	D	C	E	B	E	C	E
Between SR-133 NB/SB off-ramps and SR-133 NB/SB on-ramps	A	D	B	D	A	D	B	D	A	D	B	D
Between SR-133 NB/SB on-ramps and Irvine Center Drive off-ramp	B	C	B	C	B	D	B	D	B	D	B	D
Between Irvine Center Drive off-ramp and Irvine Center Drive loop on-ramp	B	C	B	C	B	C	B	C	B	C	B	C
Between Irvine Center Drive loop on-ramp and Irvine Center Drive direct on-ramp	B	B	B	C	B	C	B	C	B	C	B	C
Between Irvine Center Drive direct on-ramp and Bake Parkway off-ramp	B	B	B	C	B	B	B	C	B	B	B	C

Notes:
(1) HOV Lane LOS: LOS is based on v/c ratio using a capacity of 2,200 vph.
(2) GP and Auxiliary (AUX) lanes LOS: LOS is based on density (pc/mi/ln).
Bold indicates LOS exceeds LOS criteria.

Source: Traffic Study, 2017.

Under year 2030 and 2050 Alternative 1 (No Build) conditions, most of the GP lane segments are expected to operate at LOS F during the AM and PM peak hours in both directions. In the

NB direction, the following GP lane segments are expected to operate at LOS F during the AM and/or PM peak hours in 2030:

- Between Enterprise Drive on-ramp and Irvine Center Drive on-ramp (AM)
- Between Irvine Center Drive on-ramp and SR-133 SB off-ramp (AM)
- Between SR-133 SB off-ramp and SR-133 NB/SB on-ramps (AM)
- Between SR-133 NB/SB on-ramps and Sand Canyon Avenue off-ramp (AM and PM)
- Between Sand Canyon Avenue off-ramp and Sand Canyon Avenue loop on-ramp (AM and PM)
- Between Sand Canyon Avenue loop on-ramp and Sand Canyon Avenue direct on-ramp (AM and PM)
- Between Sand Canyon Avenue direct on-ramp and Jeffrey Road off-ramp (AM and PM)
- Between Jeffrey Road off-ramp and Jeffrey Road loop on-ramp (AM and PM)
- Between Jeffrey Road loop on-ramp and Jeffrey Road direct on-ramp (AM and PM)
- Between Culver Drive off-ramp and Culver Drive loop on-ramp (PM)
- Between Culver Drive direct on-ramp and Jamboree Road off-ramp (PM)
- Between Jamboree Road off-ramp and Jamboree Road loop on-ramp (PM)
- Between Jamboree Road loop on-ramp and Jamboree Road direct on-ramp (PM)
- Between Jamboree Road direct on-ramp and MacArthur Boulevard off-ramp (PM)
- Between MacArthur Boulevard off-ramp and MacArthur Boulevard on-ramp (PM)
- Between MacArthur Boulevard on-ramp and SR-55 NB/SB off-ramps (PM)

In year 2050, the same GP lane segments would still operate at LOS F during the AM and/or PM peak hours with the addition of the segment between the Culver Drive off-ramp and Culver Drive loop on-ramp, which would operate at LOS F in both the AM and PM peak periods.

In the SB direction, the following GP lane segments are expected to operate at LOS F during the AM and/or PM peak hours in 2030:

- Between SR-55 SB on-ramp and MacArthur Boulevard off-ramp (AM)
- Between MacArthur Boulevard off-ramp and MacArthur Boulevard on-ramp (AM)
- Between Culver Drive off-ramp and Culver Drive loop on-ramp (AM)
- Between Culver Drive loop on-ramp and Culver Drive direct on-ramp (AM)
- Between University Drive off-ramp and University Drive loop on-ramp (AM and PM)
- Between University Drive loop on-ramp and University Drive direct on-ramp (AM and PM)

- Between University Drive direct on-ramp and Sand Canyon Avenue off-ramp (AM and PM)

By 2050, the following GP lane segments in the SB direction are expected to operate at LOS F during the AM and/or PM peak hours, in addition to the ones listed for 2030:

- Between SR-55 SB on-ramp and MacArthur Boulevard off-ramp (PM)
- Between Jamboree Road direct on-ramp and Culver Drive off-ramp (AM)
- Between Culver Drive off-ramp and Culver Drive loop on-ramp (PM)
- Between Culver Drive loop on-ramp and Culver Drive direct on-ramp (PM)
- Between Sand Canyon Avenue off-ramp and Sand Canyon Avenue on-ramp (PM)

All HOV lane segments along I-405 within the project study area are expected to operate at LOS D or better during the AM and PM peak hours in both directions under year 2030 Alternative 1 (No Build) conditions.

Table 2.1.6-11 also presents LOS of each freeway segment under year 2050 Alternative 1 (No Build) conditions. In the NB direction, the same GP lane segments are expected to operate at LOS F during the AM and/or PM peak hours in 2050 as in 2030. In the SB direction, in addition to the same GP lane segments expected to operate at LOS F during the AM and/or PM peak hours in 2030, two additional intersections are expected to operate at LOS F during the AM and/or PM peak hours:

- Between Jamboree Road direct on-ramp and Culver Drive off-ramp (AM)
- Between Sand Canyon Avenue off-ramp and Sand Canyon Avenue on-ramp (PM)

Under year 2050 Alternative 1 (No Build) conditions, all HOV lane segments along I-405 within the project study area are expected to operate at LOS D or better during the AM and PM peak hours in both directions.

Ramps and Ramp-Freeway Junction

Under both 2030 and 2050 Alternative 1 (No Build) conditions, the following NB ramp junction locations operate at LOS F during either the AM or PM peak hour:

- Jeffrey Road/University Drive loop on-ramp (AM and PM)
- Jeffrey Road/University Drive direct on-ramp (AM)
- Culver Drive direct off-ramp (AM)
- Culver Drive direct on-ramp (PM)

- Jamboree Road direct off-ramp (PM)
- Jamboree Road loop on-ramp (PM)

For the SB ramp junction locations, the following locations are anticipated to operate at LOS F during either the AM or PM peak hour in 2030:

- Culver Drive loop on-ramp (AM)
- Jeffrey Road/University Drive loop on-ramp (AM and PM)

In 2050, the following SB ramp junctions are expected to also degrade to LOS F during the AM and PM peak hours:

- Jamboree Road direct on-ramp (AM)
- Culver Drive loop on-ramp (PM)

The freeway ramp junction locations listed above operate at LOS F due to the LOS F condition for the GP segment upstream and downstream of the ramp.

Average Peak-Hour Speed, Vehicle Hours of Delay, and Cost of Delay

As shown in Table 2.1.6-12, for year 2030 Alternative 1 (No Build), average speeds in the GP lanes on NB I-405 for a trip within the project limits are 43 and 42 mph for the AM and PM peak hours, respectively. In 2050, those speeds fall to 40 and 39 mph during the AM and PM peak hours, respectively. Average speeds in the HOV lanes on NB I-405 for a trip within the project limits are 56 and 62 mph for the AM and PM peak hours, respectively. In 2050, those speeds fall to 55 mph in both the AM and PM peak hours. On SB I-405 in 2030, average speeds in the GP lanes are 48 mph during the AM and PM peak hours. In 2050, those speeds fall to 43 mph. In 2030, average speeds in the HOV lanes on SB I-405 for a trip within the project limits is 63 and 59 mph for the AM and PM peak hours, respectively. In 2050, average speeds in the HOV lanes on SB I-405 are 63 and 58 mph in the AM and PM peak hours, respectively.

Table 2.1.6-12. Alternative 1 I-405 Freeway Mainline Average Speed (mph)

Peak Hour	Project Limits – I-5 to SR-55						Area of GP Lane Addition					
	Existing (Year 2015)		Opening Year 2030		Design Year 2050		Existing (Year 2015)		Opening Year 2030		Design Year 2050	
	HOV	GP	HOV	GP	HOV	GP	HOV	GP	HOV	GP	HOV	GP
Northbound I-405												
AM	50	47	56	43	55	40	56	45	54	41	53	37
PM	61	44	62	42	62	39	63	46	62	43	61	40

Table 2.1.6-12. Alternative 1 I-405 Freeway Mainline Average Speed (mph)

Peak Hour	Project Limits – I-5 to SR-55						Area of GP Lane Addition					
	Existing (Year 2015)		Opening Year 2030		Design Year 2050		Existing (Year 2015)		Opening Year 2030		Design Year 2050	
	HOV	GP	HOV	GP	HOV	GP	HOV	GP	HOV	GP	HOV	GP
Southbound I-405												
AM	61	49	63	48	63	43	64	51	50	63	46	50
PM	56	38	59	48	58	43	60	45	48	58	45	48

Source: Traffic Study, 2017.

For a trip within the area of the GP lane additions, average speeds in the GP lanes on NB I-405 are 41 and 43 mph in the AM and PM peak hours, respectively. In year 2050, those speeds fall to 37 and 40 mph, respectively. Average speeds in the HOV lanes along NB I-405 for a trip within the area of GP lane additions are 54 and 62 mph for the AM and PM peak hours, respectively. In 2050, those speeds fall to 53 and 61 mph. On SB I-405 in 2030, average speeds in the GP lanes are 50 and 48 mph in the AM and PM peak hours, respectively. In year 2050, those speeds fall to 46 and 45 mph, respectively. Average speeds along HOV lanes within the area of the GP lane additions are 64 and 59 mph for the AM and PM peak hours in 2030, with a drop of 1 mph in 2050.

Under year 2030 Alternative 1 conditions, there would be approximately 9,000 vehicle hours of delay on I-405 within the study area on a typical weekday. On an annual basis, there would be approximately 2.3 million vehicle hours of delay on I-405, which represents an approximate $65 million annual cost of delay. Under year 2050 Alternative 1 conditions, there are approximately 14,300 vehicle hours of delay on I-405 within the study area on a typical weekday. On an annual basis, there are approximately 3.6 million vehicle hours of delay on I-405, which represents an approximate $101 million annual cost of delay.

Intersections

Alternative 1 (No Build) includes various interchange and arterial improvements along I-405 within the project study area planned by the City of Irvine and Caltrans, as summarized in the Traffic Study (2017).

Under years 2030 and 2050, the intersection at Entertainment/Enterprise Drive and I-405 NB ramps is expected to operate at LOS F during the PM peak hour. In 2050, the intersection at Jamboree Road and I-405 SB ramps is also expected to operate at LOS F during the AM peak hour. The remaining Caltrans study intersections are expected to operate at LOS E or better.

Regarding City of Irvine intersections, in 2030 the intersection of Jeffrey Road and Alton Parkway is expected to operate at LOS E and LOS F during the AM and PM peak hours, respectively. In 2050, that intersection would operate at LOS F in the AM peak hour as well. The intersection of Culver Drive and University Drive is expected to operate at LOS E during the PM peak hour in both 2030 and 2050. The remaining study intersections within jurisdiction of the City of Irvine are expected to operate at acceptable LOS.

Table 2.1.6-13 summarizes study area intersection LOS in Opening Year 2030 and Design Year 2050.

Table 2.1.6-13. Alternative 1 (No Build) 2030 and 2050 Intersection Level of Service Summary

#	Intersection Location	LOS Criterion	Agency Jurisdiction	Peak-Hour LOS							
				Opening Year 2030				Design Year 2050			
				Caltrans HCM – 2010		City of Irvine – ICU		Caltrans HCM – 2010		City of Irvine – ICU	
				AM	PM	AM	PM	AM	PM	AM	PM
1*	NB I-405/Fortune Drive (NS) & Entertainment/Enterprise Drive (EW)	*	Caltrans	C	F	—	—	C	F	—	—
2	Irvine Center Drive (NS) & Entertainment/Enterprise Drive (EW)	E	Caltrans	A	C	—	—	A	C	—	—
3	Irvine Center Drive (NS) & SB I-405 (EW)	E	Caltrans	B	B	—	—	B	A	—	—
4	Irvine Center Drive (NS) & Research Drive (EW)	D	Irvine	—	—	A	A	—	—	B	A
5	Sand Canyon Avenue (NS) & Alton Parkway (EW)	D	Irvine	—	—	B	B	—	—	B	C
6	Sand Canyon Avenue (NS) & NB I-405 (EW)	E	Caltrans	A	B	—	—	A	A	—	—
7	Sand Canyon Avenue (NS) & SB I-405 (EW)	E	Caltrans	D	C	—	—	E	C	—	—
8	Sand Canyon Avenue (NS) & Quail Hill Parkway (EW)	D	Irvine	A	B	—	—	A	B	—	—
9	Jeffrey Road (NS) & Alton Parkway (EW)	D	Irvine	—	—	**E**	**F**	—	—	**F**	**F**
10	Jeffrey Road (NS) & Quail Creek (EW)	D	Irvine	—	—	C	C	—	—	D	C
11	Jeffrey Road/University Drive (NS) & NB I-405 (EW)	E	Caltrans	B	C	—	—	B	C	—	—
12	Jeffrey Road/University Drive (NS) & SB I-405 (EW)	E	Caltrans	A	B	—	—	A	A	—	—

Table 2.1.6-13. Alternative 1 (No Build) 2030 and 2050 Intersection Level of Service Summary

#	Intersection Location	LOS Criterion	Agency Jurisdiction	Peak-Hour LOS							
				Opening Year 2030				Design Year 2050			
				Caltrans HCM – 2010		City of Irvine – ICU		Caltrans HCM – 2010		City of Irvine – ICU	
				AM	PM	AM	PM	AM	PM	AM	PM
13	Culver Drive (NS) & NB I-405 (EW)	E	Caltrans	B	B	—	—	C	C	—	—
14	Culver Drive (NS) & SB I-405 (EW)	E	Caltrans	C	C	—	—	D	C	—	—
15	Culver Drive (NS) & Michelson Drive (EW)	D	Irvine	—	—	B	D	—	—	C	D
16	Culver Drive (NS) & University Drive (EW)	D	Irvine	—	—	C	**E**	—	—	C	**E**
17	Jamboree Road (NS) & Main Street (EW)	E	Irvine	—	—	C	D	—	—	C	D
18	Jamboree Road (NS) & NB I-405 (EW)	E	Caltrans	B	B	—	—	B	B	—	—
19	Jamboree Road (NS) & SB I-405 (EW)	E	Caltrans	E	D	—	—	**F**	C	—	—
20	Jamboree Road (NS) & Michelson Drive (EW)	E	Irvine	—	—	C	D	—	—	D	E
21	MacArthur Boulevard (NS) & Main Street (EW)	E	Irvine	—	—	B	C	—	—	B	C
22	MacArthur Boulevard (NS) & NB I-405 (EW)	E	Caltrans	C	B	—	—	B	D	—	—
23	MacArthur Boulevard (NS) & SB I-405 (EW)	E	Caltrans	C	B	—	—	D	B	—	—
24	MacArthur Boulevard (NS) & Michelson Drive (EW)	E	Irvine	—	—	C	D	—	—	C	D

Notes: LOS – Level of Service; v/c – Volume-to-Capacity; d/c – Demand Volume-to-Capacity; (NS) – North-South Direction; (EW) – East-West Direction

Bold indicates LOS exceeds LOS criteria.

* Entertainment/Enterprise Drive and Fortune Drive are not designated highway arterials; thus, the criteria defined in Section 2.1.6.2 does not apply to this intersection.

Source: Traffic Study, 2017.

Arterial Segment

Arterial segment analysis was performed for the "No Build" condition to determine whether any of the arterial segments would exceed the City of Irvine acceptable LOS by opening year 2030 and design year 2050. As summarized in Table 2.1.6-14, arterial segment analysis indicates that the following segments would exceed the City of Irvine acceptable LOS by year 2030:

- Jeffrey Road between Alton Parkway and Quail Creek Road
- Jeffrey Road between Quail Creek Road and NB I-405 ramps
- University Drive between SB I-405 ramps and Michelson Drive
- University Drive between Yale Avenue and Culver Drive
- Culver Drive between SB I-405 ramps and Michelson Drive

Also, the arterial segment ADT analysis indicates that the following segment would exceed the City of Irvine acceptable LOS by year 2050:

- Sand Canyon Avenue between Alton Parkway and NB I-405 ramps

Table 2.1.6-14. Alternative 1 (No Build) 2030 and 2050 Arterial Segment Level of Service Summary

#	Arterial	From	To	LOS Criteria	Opening Year 2030 - LOS	Design Year 2050 - LOS
1	Irvine Center Drive	I-405 SB ramps	Research Drive	D	<D	<D
2	Sand Canyon Avenue	Alton Parkway	I-405 NB ramps	D	<D	**>D**
3	Sand Canyon Avenue	I-405 SB ramps	Quail Hill Parkway	D	<D	<D
4	Alton Parkway	Jeffrey Road	Sand Canyon Avenue	D	<D	<D
5	Jeffrey Road	Alton Parkway	Quail Creek Road	D	**>D**	**>D**
6	Jeffrey Road	Quail Creek Road	I-405 NB ramps	D	**>D**	**>D**
7	University Drive	I-405 SB ramps	Michelson Drove	D	**>D**	**>D**
8	University Drive	Yale Avenue	Culver Drive	D	**>D**	**>D**
9	Culver Drive	I-405 SB ramps	Michelson Drive	D	**>D**	**>D**
10	Culver Drive	Michelson Drive	Sandburg	D	<D	<D
11	Culver Drive	Sandburg	University Drive	D	<D	<D
12	Jamboree Road	Main Street	I-405 NB ramps	E	<E	<E
13	Jamboree Road	I-405 SB ramps	Michelson Drive	E	<E	<E
14	MacArthur Boulevard	Main Street	I-405 NB ramps	E	<E	<E
15	MacArthur Boulevard	I-405 SB ramps	Michelson Drive	E	<E	<E

Notes: LOS – Level of Service
Bold indicates LOS exceeds LOS criteria.

Source: Traffic Study, 2017.

Construction (Short-Term) Impacts

Alternative 1 would not result in any improvements. As such, there would be no construction or short-term impacts.

Alternative 2 (Build – One GP Lane in Each Direction) (Preferred Alternative)

Alternative 2 proposes to add an additional GP lane in the NB direction of I-405 between SR-133 and Culver Drive and in the SB direction between Irvine Center Drive and University Drive/Jeffrey Road. This would provide a fifth continuous GP lane from SR-133 to SR-55 in the NB direction and from Bake Parkway to SR-55 in the SB direction. Figures 2.1.6-2 and 2.1.6-3 provide schematic presentations of Alternative 2.

In addition to the additional GP lane, Alternative 2 also includes multiple other improvements to on- and off-ramps, as well as auxiliary lane improvements. Alternative 2 assumes the completion of improvements along the project corridor included in Alternative 1 (No Build).

Alternative 2 ADT is forecast to be 283,626 in 2030 and 300,558 in 2050. Weekday daily VMT on I-405 within the study area is forecast to be approximately 2.3 million miles in 2030 and 2.4 million miles in 2050 under Alternative 2. This forecasted increase in VMT versus the Alternative 1 (No Build) conditions in Design Year 2050 is approximately 3.2 percent.

Freeway Mainline

As a result of the additional NB GP lane between SR-133 and Culver Drive, the LOS in the GP lanes improves from LOS E/F to LOS E/D during the peak hours compared to Alternative 1 (No Build), except for the Sand Canyon Avenue to Jeffrey Road segment during the AM peak hour. This segment remains at LOS F under both alternatives during the AM peak hour. All other GP segments for the AM and PM peak hours, where no improvements are proposed, are expected to operate at the same or slightly lower LOS than Alternative 1 (No Build). HOV lanes are expected to operate at the same LOS as Alternative 1 (No Build).

In the SB direction, Alternative 2 adds a single GP lane between Culver Drive and Irvine Center Drive, providing a fifth continuous GP lane from MacArthur Boulevard to Irvine Center Drive. As a result of the additional SB GP lane, the LOS in the GP lanes between Culver Drive and Irvine Center Drive during the peak hours improves or remains the same in Alternative 2 as in Alternative 1. North of Culver Drive, where no improvements are proposed, LOS deteriorates slightly or is projected to operate at LOS F under Alternatives 1 and 2.

Under Alternative 1 (No Build) conditions, 9 out of the 14 mainline segments where improvements are proposed operate at LOS F. Under Alternative 2, the addition of one GP

lane decreases the number of LOS F segments from 9 to 8 segments, thus improving traffic operations along I-405.

Table 2.1.6-15 presents the LOS of each freeway segment under Alternative 2 in Opening Year 2030 and Design Year 2050.

Table 2.1.6-15. Alternative 2 (Preferred Alternative) Opening Year 2030 and Design Year 2050 Condition I-405 Freeway Mainline Segment Peak-Hour Level of Service

Segments	Existing (Year 2015)				Opening Year 2030				Design Year 2050			
	AM		PM		AM		PM		AM		PM	
	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]
Northbound												
Between Enterprise Drive off-ramp and truck bypass lane on-ramp	C	D	B	B	C	D	B	C	C	E	B	C
Between truck bypass lane on-ramp and Enterprise Drive on-ramp	C	C	B	B	C	D	B	C	C	D	B	C
Between Enterprise Drive on-ramp and Irvine Center Drive on-ramp	C	**F**	B	C	C	D	B	C	C	E	B	C
Between Irvine Center Drive on-ramp and SR-133 SB off-ramp	C	**F**	B	C	C	D	B	D	C	E	B	D
Between SR-133 SB off-ramp and SR-133 NB/SB on-ramps	C	**F**	B	D	C	D	B	D	C	E	B	D
Between SR-133 NB/SB on-ramps and Sand Canyon Avenue off-ramp	C	**F**	B	**F**	C	E	B	C	C	E	B	D
Between Sand Canyon Avenue off-ramp and Sand Canyon Avenue loop on-ramp	C	**F**	B	**F**	C	E	B	D	C	E	B	D
Between Sand Canyon Avenue loop on-ramp and Sand Canyon Avenue direct on-ramp	C	**F**	C	E	C	E	C	D	D	**F**	C	D
Between Sand Canyon Avenue direct on-ramp and Jeffrey Road off-ramp	C	**F**	C	E	C	**F**	C	D	D	**F**	C	E
Between Jeffrey Road off-ramp and Jeffrey Road loop on-ramp	C	**F**	C	E	C	**F**	C	E	D	**F**	C	E
Between Jeffrey Road loop on-ramp and Jeffrey Road direct on-ramp	C	**F**	C	E	C	E	C	D	D	**F**	C	D
Between Jeffrey Road direct on-ramp and Culver Drive off-ramp	C	D	C	D	C	D	C	D	D	E	C	D
Between Culver Drive off-ramp and Culver Drive loop on-ramp	C	E	C	**F**	C	D	C	E	D	E	C	E

Table 2.1.6-15. Alternative 2 (Preferred Alternative) Opening Year 2030 and Design Year 2050 Condition I-405 Freeway Mainline Segment Peak-Hour Level of Service

Segments	Existing (Year 2015)				Opening Year 2030				Design Year 2050			
	AM		PM		AM		PM		AM		PM	
	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]
Between Culver Drive loop on-ramp and Culver Drive direct on-ramp	C	D	C	D	C	D	C	D	D	E	C	E
Between Culver Drive direct on-ramp and Jamboree Road off-ramp	B	E	C	E	B	E	C	**F**	B	**F**	C	**F**
Between Jamboree Road off-ramp and Jamboree Road loop on-ramp	B	D	C	**F**	B	E	C	**F**	B	E	C	**F**
Between Jamboree Road loop on-ramp and Jamboree Road direct on-ramp	B	D	C	**F**	B	E	C	**F**	B	E	C	**F**
Between Jamboree Road direct on-ramp and MacArthur Boulevard off-ramp	B	D	C	**F**	B	E	C	**F**	B	E	C	**F**
Between MacArthur Boulevard off-ramp and MacArthur Boulevard on-ramp	B	D	B	**F**	B	D	C	**F**	B	D	C	**F**
Between MacArthur Boulevard on-ramp and SR-55 NB/SB off-ramps	B	C	B	**F**	B	D	C	**F**	B	D	C	**F**
Southbound												
Between SR-55 SB on-ramp and MacArthur Boulevard off-ramp	C	**F**	B	**F**	C	**F**	B	**F**	C	**F**	C	**F**
Between MacArthur Boulevard off-ramp and MacArthur Boulevard on-ramp	C	E	C	**F**	C	**F**	C	**F**	C	**F**	C	**F**
Between MacArthur Boulevard on-ramp and Jamboree Road off-ramp	C	C	C	**F**	C	D	C	E	C	E	C	**F**
Between Jamboree Road off-ramp and Jamboree Road loop on-ramp	C	D	C	**F**	C	D	C	E	C	E	C	**F**
Between Jamboree Road loop on-ramp and Jamboree Road direct on-ramp	C	D	C	**F**	C	D	C	E	C	E	C	**F**
Between Jamboree Road direct on-ramp and Culver Drive off-ramp	C	E	C	**F**	C	**F**	C	E	C	**F**	C	**F**
Between Culver Drive off-ramp and Culver Drive loop on-ramp	C	**F**	C	**F**	C	E	C	D	C	**F**	C	E
Between Culver Drive loop on-ramp and Culver Drive direct on-ramp	C	**F**	C	**F**	C	E	C	D	C	**F**	C	E

Table 2.1.6-15. Alternative 2 (Preferred Alternative) Opening Year 2030 and Design Year 2050 Condition I-405 Freeway Mainline Segment Peak-Hour Level of Service

Segments	Existing (Year 2015)				Opening Year 2030				Design Year 2050			
	AM		PM		AM		PM		AM		PM	
	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]
Between Culver Drive direct on-ramp and University Drive off-ramp	B	**F**	C	**F**	C	D	C	D	C	E	C	E
Between University Drive off-ramp and University Drive loop on-ramp	B	**F**	C	**F**	C	**F**	C	**F**	C	**F**	C	**F**
Between University Drive loop on-ramp and University Drive direct on-ramp	B	**F**	C	**F**	C	**F**	C	**F**	C	**F**	C	**F**
Between University Drive direct on-ramp and Sand Canyon Avenue off-ramp	B	**F**	C	**F**	B	E	C	E	B	**F**	C	E
Between Sand Canyon Avenue off-ramp and Sand Canyon Avenue on-ramp	B	D	C	E	B	D	C	D	B	D	C	E
Between Sand Canyon Avenue on-ramp and SR-133 NB/SB Off Ramps	B	D	C	E	B	C	C	D	B	D	C	D
Between SR-133 NB/SB off-ramps and SR-133 NB/SB on-ramps	A	D	B	D	A	C	B	C	A	C	B	C
Between SR-133 NB/SB on-ramps and Irvine Center Drive off-ramp	B	C	B	C	B	B	B	B	B	B	B	C
Between Irvine Center Drive off-ramp and Irvine Center Drive loop on-ramp	B	C	B	C	B	C	B	C	B	C	B	C
Between Irvine Center Drive loop on-ramp and Irvine Center Drive direct on-ramp	B	B	B	C	B	C	B	C	B	C	B	C
Between Irvine Center Drive direct on-ramp and Bake Parkway off-ramp	B	B	B	C	B	C	B	C	B	C	B	C

Notes:
(1) HOV Lane LOS: LOS is based on v/c ratio using a capacity of 2,200 vph.
(2) GP and Auxiliary (AUX) lanes LOS: LOS is based on density (pc/mi/ln).
Bold indicates LOS exceeds LOS criteria.

Source: Traffic Study, 2017.

Ramps and Ramp-Freeway Junction

Under year 2030 Alternative 2 conditions, the following NB ramp junction locations operate at LOS F during either the AM or PM peak hour:

- Sand Canyon Avenue direct on-ramp (AM)

- Culver Drive direct on-ramp (PM)
- Jamboree Road loop on-ramp (PM)

In 2050, the same NB ramp junction locations operate at LOS F during either the AM or PM peak hour in addition to the following ramp junctions:

- Sand Canyon Avenue loop on-ramp (AM)
- Culver Drive direct on-ramp (AM)

For the SB ramp junction locations, the following locations are anticipated to operate at LOS F during either the AM or PM peak hour in 2030:

- Jamboree Road direct on-ramp (AM)
- Jeffrey Road/University Drive loop on-ramp (AM and PM)

In 2050, the following SB ramp junctions are expected to also degrade to LOS F during the AM and PM peak hours:

- Jamboree Road direct on-ramp (AM)
- Culver Drive loop on-ramp (PM)

The freeway ramp junction locations listed above operate at LOS F due to the LOS F condition for the GP segment upstream and downstream of the ramp.

Average Peak-Hour Speed, Vehicle Hours of Delay, and Cost of Delay

Table 2.1.6-16 summarizes expected speeds for the GP lanes and HOV lanes under Alternative 2 in Opening Year 2030 and Design Year 2050. As discussed previously, speeds are provided for an entire trip within the project limits from I-5 to SR-55, as well as speed for a trip within the area where Alternative 2 would provide an additional lane on the freeway mainline. A trip along the entire corridor on GP lanes under Alternative 2 is anticipated to be 1 to 8 mph faster compared to Alternative 1 (No Build) conditions. The HOV speeds are expected to be the same or slightly faster than Alternative 1 (No Build) conditions. For a trip within the area of project improvements, GP lane speeds are expected to be 10 to 14 mph faster compared to Alternative 1 (No Build) conditions. HOV speeds are expected to be the same or slightly higher.

Table 2.1.6-16. Alternative 2 (Preferred Alternative) I-405 Freeway Mainline Average Speed (mph)

Peak Hour	Project Limits – I-5 to SR-55						Area of GP Lane Addition					
	Existing (Year 2015)		Opening Year 2030		Design Year 2050		Existing (Year 2015)		Opening Year 2030		Design Year 2050	
	HOV	GP	HOV	GP	HOV	GP	HOV	GP	HOV	GP	HOV	GP
Northbound I-405												
AM	50	47	57	52	56	48	56	45	55	55	54	51
PM	61	44	63	44	62	42	63	46	62	54	61	51
Southbound I-405												
AM	61	49	63	54	63	50	64	51	64	61	64	57
PM	56	38	59	49	59	44	60	45	59	59	59	55

Source: Traffic Study, 2017.

There would be approximately 7,400 and 9,400 vehicle hours of delay on I-405 within the study area on a typical weekday under 2030 and 2050 conditions, respectively. In 2030, there would be approximately 1.8 million vehicle hours of delay annually on the freeway, which represents an approximate $53 million annual cost of delay. Under year 2050 Alternative 2 conditions, there would be approximately 2.4 million vehicle hours of delay on I-405, which represents an approximate $67 million annual cost of delay. Compared to Alternative 1 (No Build) conditions, Alternative 2 would save approximately 1.2 million vehicle hours of delay and $34 million in delay costs annually in 2050.

Intersections

Alternative 2 assumes the completion of improvements at the arterial intersections included in Alternative 1 (No Build). The intersections analyzed for Alternative 2 conditions are the same intersections analyzed under Alternative 1 (No Build) conditions.

Among intersections within Caltrans ROW, all intersections are expected to operate at or above the LOS requirement under both 2030 and 2050 Alternative 2 conditions.

For intersections under City of Irvine jurisdiction, the intersection of Jeffrey Road and Alton Parkway is expected to operate at LOS E during the PM peak hour in 2030. By 2050, operations at this intersection are expected to worsen to LOS E and F during the AM and PM peak hours, respectively. The intersection of Culver Drive and University Drive is expected to operate at LOS E during the PM peak hour in both 2030 and 2050. The remaining study intersections are expected to operate at or above the LOS requirement. Though these intersections operate at

unacceptable LOS levels, the project decreases the d/c ratio compared to Alternative 1 (No Build) conditions. As such, this is not considered a significant impact associated with Alternative 2. There are no significant impacts to the study intersections.

A summary of LOS for Opening Year 2030 and Design Year 2050 intersection LOS is provided in Table 2.1.6-17.

Table 2.1.6-17. Alternative 2 (Preferred Alternative) 2030 and 2050 Intersection Level of Service Summary

#	Intersection Location	LOS Criterion	Agency Jurisdiction	Peak-Hour LOS							
				Opening Year 2030				Design Year 2050			
				Caltrans HCM - 2010		City of Irvine - ICU		Caltrans HCM - 2010		City of Irvine - ICU	
				AM	PM	AM	PM	AM	PM	AM	PM
1*	NB I-405/Fortune Drive (NS) & Entertainment/ Enterprise Drive (EW)	E	Caltrans	D	**F**	—	—	C	**F**	—	—
2	Irvine Center Drive (NS) & Entertainment/Enterprise Drive (EW)	E	Caltrans	B	C	—	—	A	C	—	—
3	Irvine Center Drive (NS) & SB I-405 (EW)	E	Caltrans	C	B	—	—	B	B	—	—
4	Irvine Center Drive (NS) & Research Drive (EW)	D	Irvine	—	—	A	A	—	—	A	A
5	Sand Canyon Avenue (NS) & Alton Parkway (EW)	D	Irvine	—	—	C	C	—	—	C	C
6	Sand Canyon Avenue (NS) & NB I-405 (EW)	E	Caltrans	B	C	—	—	A	A	—	—
7	Sand Canyon Avenue (NS) & SB I-405 (EW)	E	Caltrans	D	C	—	—	E	C	—	—
8	Sand Canyon Avenue (NS) & Quail Hill Parkway (EW)	D	Irvine	A	B	—	—	A	B	—	—
9	Jeffrey Road (NS) & Alton Parkway (EW)	D	Irvine	—	—	D	**E**	—	—	**E**	**F**
10	Jeffrey Road (NS) & Quail Creek (EW)	D	Irvine	—	—	C	C	—	—	C	C
11	Jeffrey Road/University Drive (NS) & NB I-405 (EW)	E	Caltrans	B	B	—	—	C	C	—	—
12	Jeffrey Road/University Drive (NS) & SB I-405 (EW)	E	Caltrans	A	A	—	—	A	B	—	—

Table 2.1.6-17. Alternative 2 (Preferred Alternative) 2030 and 2050 Intersection Level of Service Summary

#	Intersection Location	LOS Criterion	Agency Jurisdiction	Peak-Hour LOS							
				Opening Year 2030				Design Year 2050			
				Caltrans HCM - 2010		City of Irvine - ICU		Caltrans HCM - 2010		City of Irvine - ICU	
				AM	PM	AM	PM	AM	PM	AM	PM
13	Culver Drive (NS) & NB I-405 (EW)	E	Caltrans	B	D	—	—	C	E	—	—
14	Culver Drive (NS) & SB I-405 (EW)	E	Caltrans	C	C	—	—	C	C	—	—
15	Culver Drive (NS) & Michelson Drive (EW)	D	Irvine	—	—	B	D	—	—	B	D
16	Culver Drive (NS) & University Drive (EW)	D	Irvine	—	—	C	**E**	—	—	C	**E**
17	Jamboree Road (NS) & Main Street (EW)	E	Irvine	—	—	D	D	—	—	C	D
18	Jamboree Road (NS) & NB I-405 (EW)	E	Caltrans	B	B	—	—	B	B	—	—
19	Jamboree Road (NS) & SB I-405 (EW)	E	Caltrans	D	C	—	—	E	B	—	—
20	Jamboree Road (NS) & Michelson Drive (EW)	E	Irvine	—	—	C	D	—	—	D	E
21	MacArthur Boulevard (NS) & Main Street (EW)	E	Irvine	—	—	B	C	—	—	B	C
22	MacArthur Boulevard (NS) & NB I-405 (EW)	E	Caltrans	C	B	—	—	B	C	—	—
23	MacArthur Boulevard (NS) & SB I-405 (EW)	E	Caltrans	C	B	—	—	D	B	—	—
24	MacArthur Boulevard (NS) & Michelson Drive (EW)	E	Irvine	—	—	B	D	—	—	C	D

Notes: LOS – Level of Service; v/c – Volume-to-Capacity; d/c – Demand Volume-to-Capacity; (NS) – North-South Direction; (EW) – East-West Direction

Bold indicates LOS exceeds LOS criteria.

* Entertainment/Enterprise Drive and Fortune Drive are not designated highway arterials; thus, the criteria defined in Section 2.1.6.2 does not apply to this intersection.

Source: Traffic Study, 2017.

Arterial Segments

Arterial segment analysis was performed for Alternative 2. As shown in Table 2.1.6-18, the following arterial segments exceed the City of Irvine acceptable LOS in 2030 under Alternative 2 conditions:

- Jeffrey Road between Alton Parkway and Quail Creek Road
- Jeffrey Road between Quail Creek Road and NB I-405 ramps
- University Drive between SB I-405 ramps and Michelson Drive
- University Drive between Yale Avenue and Culver Drive
- Culver Drive between SB I-405 ramps and Michelson Drive

In 2050, the arterial segments above continue to exceed the City of Irvine acceptable LOS with the addition of another segment at:

- Sand Canyon between Alton Parkway and I-405 NB ramps

Table 2.1.6-18. Alternative 2 (Preferred Alternative) 2030 and 2050 Arterial Segment Level of Service Summary

#	Arterial	From	To	LOS Criteria	Opening Year 2030 - LOS	Design Year 2050 - LOS	Exceeds Impact Threshold
1	Irvine Center Drive	I-405 SB ramps	Research Drive	D	<D	<D	No
2	Sand Canyon Avenue	Alton Parkway	I-405 NB ramps	D	<D	**>D**	No
3	Sand Canyon Avenue	I-405 SB ramps	Quail Hill Parkway	D	<D	<D	No
4	Alton Parkway	Jeffrey Road	Sand Canyon Avenue	D	<D	<D	No
5	Jeffrey Road	Alton Parkway	Quail Creek Road	D	**>D**	**>D**	No
6	Jeffrey Road	Quail Creek Road	I-405 NB ramps	D	**>D**	**>D**	No
7	University Drive	I-405 SB ramps	Michelson Drive	D	**>D**	**>D**	No
8	University Drive	Yale Avenue	Culver Drive	D	**>D**	**>D**	No
9	Culver Drive	I-405 SB ramps	Michelson Drive	D	**>D**	**>D**	No
10	Culver Drive	Michelson Drive	Sandburg	D	<D	<D	No
11	Culver Drive	Sandburg	University Drive	D	<D	<D	No
12	Jamboree Road	Main Street	I-405 NB ramps	E	<E	<E	No

Table 2.1.6-18. Alternative 2 (Preferred Alternative) 2030 and 2050 Arterial Segment Level of Service Summary

#	Arterial	From	To	LOS Criteria	Opening Year 2030 - LOS	Design Year 2050 - LOS	Exceeds Impact Threshold
13	Jamboree Road	I-405 SB ramps	Michelson Drive	E	<E	<E	No
14	MacArthur Boulevard	Main Street	I-405 NB ramps	E	<E	<E	No
15	MacArthur Boulevard	I-405 SB ramps	Michelson Drive	E	<E	<E	No

Notes:
LOS – Level of Service
Bold indicates LOS exceeds LOS criteria.

Source: Traffic Study, 2017.

An arterial traffic impact can be measured with the difference in the d/c ratio under the peak-hour segment analysis and whether this measurement is greater than or equal to 0.02 compared to the future no-build condition. Compared to the d/c ratios under same year Alternative 1 (No Build) conditions, Alternative 2 improvements do not meet this measurement criteria; therefore, there are no adverse impacts to the arterial segments under Alternative 2.

Alternative 3 (Build – Two GP Lanes in Each Direction)

Alternative 3 would add two GP lanes in each direction of I-405 between SR-133 and Culver Drive and between SR-133 and Jamboree Road. In addition to the GP lanes, Alternative 3 would also provide various interchange improvements. Alternative 3 also assumes the completion of improvements along the project corridor included in Alternative 1 (No Build).

Alternative 3 ADT is forecast to be 288,724 in 2030 and 306,000 in 2050. Weekday daily VMT on I-405 within the study area is forecast to be approximately 2.3 million vehicle miles in 2030 and 2.4 million vehicle miles in 2050 under Alternative 3. This forecasted increase in VMT versus the Alternative 1 (No Build) conditions in Design Year 2050 is approximately 5.1 percent.

Freeway Mainline

Alternative 3 includes the GP lane included in Alternative 2 and adds a second GP lane in the NB direction of I-405 between SR-133 and Jamboree Road, providing a sixth continuous GP lane from SR-133 to Jamboree Road. As a result of the additional NB GP lanes, the LOS in the GP lanes between SR-133 and Jamboree Road improves during the AM peak hour from

LOS E/F in Alternative 1 to LOS E in Alternative 3 and during the PM peak hour from LOS E/F in Alternative 1 to LOS C/D/E in Alternative 3. All other GP segments, where no improvements are proposed, are expected to operate the same or slightly deteriorated than Alternative 1 (No Build). HOV lanes are expected to operate at the same LOS as Alternative 1 (No Build).

In the SB direction, Alternative 3 includes the GP lane included in Alternative 2 and adds a second GP lane between SR-133 and Culver Drive, providing a sixth continuous GP lane from SR-133 to MacArthur Boulevard. As a result of the additional SB GP lanes, the LOS in the GP lanes between Irvine Center Drive and Jamboree Road during the peak hours improves or remains the same in Alternative 3 as in Alternative 1; no segments between Irvine Center Drive and Jamboree Road are projected to operate at LOS F under Alternative 3. North of MacArthur Boulevard, where no improvements are proposed, LOS deteriorates slightly or is LOS F in both Alternatives 1 and 3.

Under Alternative 1 (No Build) conditions, 9 out of the 14 mainline segments where improvements are proposed operate at LOS F. Under Alternative 3, the addition of two GP lanes decreases the number of LOS F segments from 9 to three segments, thus greatly improving traffic operations along I-405.

Table 2.1.6-19 presents the LOS of each freeway segment under Build Alternative 3 in Opening Year 2030 and Design Year 2050.

Table 2.1.6-19. Alternative 3 Opening Year 2030 and Design Year 2050 Condition I-405 Freeway Mainline Segment Peak-Hour Level of Service

Segments	Existing (Year 2015)				Opening Year 2030				Design Year 2050			
	AM		PM		AM		PM		AM		PM	
	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]
Northbound												
Between Enterprise Drive off-ramp and truck bypass lane on-ramp	C	D	B	B	C	D	B	C	C	E	B	C
Between truck bypass lane on-ramp and Enterprise Drive on-ramp	C	C	B	B	C	D	B	C	C	D	B	C
Between Enterprise Drive on-ramp and Irvine Center Drive on-ramp	C	**F**	B	C	C	D	B	C	C	E	B	C
Between Irvine Center Drive on-ramp and SR-133 SB off-ramp	C	**F**	B	C	C	E	B	D	C	E	B	E

Table 2.1.6-19. Alternative 3 Opening Year 2030 and Design Year 2050 Condition I-405 Freeway Mainline Segment Peak-Hour Level of Service

Segments	Existing (Year 2015)				Opening Year 2030				Design Year 2050			
	AM		PM		AM		PM		AM		PM	
	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]
Between SR-133 SB off-ramp and SR-133 NB/SB on-ramps	C	**F**	B	D	C	E	B	D	C	E	B	D
Between SR-133 NB/SB on-ramps and Sand Canyon Avenue off-ramp	C	**F**	B	**F**	C	E	B	C	C	E	B	D
Between Sand Canyon Avenue off-ramp and Sand Canyon Avenue loop on-ramp	C	**F**	B	**F**	C	E	B	D	C	**F**	B	D
Between Sand Canyon Avenue loop on-ramp and Sand Canyon Avenue direct on-ramp	C	**F**	C	E	C	E	C	C	D	**F**	C	C
Between Sand Canyon Avenue direct on-ramp and Jeffrey Road off-ramp	C	**F**	C	E	C	D	C	C	D	E	C	C
Between Jeffrey Road off-ramp and Jeffrey Road loop on-ramp	C	**F**	C	E	C	E	C	D	D	**F**	C	D
Between Jeffrey Road loop on-ramp and Jeffrey Road direct on-ramp	C	**F**	C	E	C	E	C	D	D	**F**	C	D
Between Jeffrey Road direct on-ramp and Culver Drive off-ramp	C	D	C	D	C	D	C	D	D	E	C	D
Between Culver Drive off-ramp and Culver Drive loop on-ramp	C	E	C	**F**	C	D	C	D	D	D	C	D
Between Culver Drive loop on-ramp and Culver Drive direct on-ramp	C	D	C	D	C	D	C	D	D	E	C	D
Between Culver Drive direct on-ramp and Jamboree Road off-ramp	B	E	C	E	B	E	C	E	B	E	C	E
Between Jamboree Road off-ramp and Jamboree Road loop on-ramp	B	D	C	**F**	B	E	C	**F**	B	**F**	C	**F**
Between Jamboree Road loop on-ramp and Jamboree Road direct on-ramp	B	D	C	**F**	B	E	C	**F**	B	**F**	C	**F**
Between Jamboree Road direct on-ramp and MacArthur Boulevard off-ramp	B	D	C	**F**	B	E	C	**F**	B	**F**	C	**F**
Between MacArthur Boulevard off-ramp and MacArthur Boulevard on-ramp	B	D	B	**F**	B	D	C	**F**	B	E	C	**F**

Table 2.1.6-19. Alternative 3 Opening Year 2030 and Design Year 2050 Condition I-405 Freeway Mainline Segment Peak-Hour Level of Service

Segments	Existing (Year 2015)				Opening Year 2030				Design Year 2050			
	AM		PM		AM		PM		AM		PM	
	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]
Between MacArthur Boulevard on-ramp and SR-55 NB/SB off-ramps	B	C	B	**F**	B	D	C	**F**	B	E	C	**F**
Southbound												
Between SR-55 SB on-ramp and MacArthur Boulevard off-ramp	C	**F**	B	**F**	C	F	B	**F**	C	**F**	C	**F**
Between MacArthur Boulevard off-ramp and MacArthur Boulevard on-ramp	C	E	C	**F**	C	F	C	**F**	C	**F**	C	**F**
Between MacArthur Boulevard on-ramp and Jamboree Road off-ramp	C	C	C	**F**	C	D	C	C	C	D	C	D
Between Jamboree Road off-ramp and Jamboree Road loop on-ramp	C	D	C	**F**	C	C	C	C	C	D	C	D
Between Jamboree Road loop on-ramp and Jamboree Road direct on-ramp	C	D	C	**F**	C	D	C	C	C	D	C	D
Between Jamboree Road direct on-ramp and Culver Drive off-ramp	C	E	C	**F**	C	D	C	D	C	E	C	D
Between Culver Drive off-ramp and Culver Drive loop on-ramp	C	**F**	C	**F**	C	D	C	D	C	E	C	E
Between Culver Drive loop on-ramp and Culver Drive direct on-ramp	C	**F**	C	**F**	C	E	C	E	C	E	C	**F**
Between Culver Drive direct on-ramp and University Drive off-ramp	B	**F**	C	F	B	D	C	D	C	E	C	E
Between University Drive off-ramp and University Drive loop on-ramp	B	**F**	C	**F**	B	D	C	D	C	E	C	E
Between University Drive loop on-ramp and University Drive direct on-ramp	B	**F**	C	**F**	B	E	C	E	C	E	C	E
Between University Drive direct on-ramp and Sand Canyon Avenue off-ramp	B	**F**	C	**F**	B	C	C	D	B	C	C	D
Between Sand Canyon Avenue off-ramp and Sand Canyon Avenue on-ramp	B	D	C	E	B	C	C	D	B	C	C	D
Between Sand Canyon Avenue on-ramp and SR-133 NB/SB Off Ramps	B	D	C	E	B	C	C	C	B	D	C	D

Table 2.1.6-19. Alternative 3 Opening Year 2030 and Design Year 2050 Condition I-405 Freeway Mainline Segment Peak-Hour Level of Service

Segments	Existing (Year 2015)				Opening Year 2030				Design Year 2050			
	AM		PM		AM		PM		AM		PM	
	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]	HOV[1]	GP & Aux[2]
Between SR-133 NB/SB off-ramps and SR-133 NB/SB on-ramps	A	D	B	D	A	C	B	C	A	D	B	C
Between SR-133 NB/SB on-ramps and Irvine Center Drive off-ramp	B	C	B	C	B	B	B	C	B	C	B	C
Between Irvine Center Drive off-ramp and Irvine Center Drive loop on-ramp	B	C	B	C	B	C	B	C	B	C	B	C
Between Irvine Center Drive loop on-ramp and Irvine Center Drive direct on-ramp	B	B	B	C	B	C	B	C	B	C	B	C
Between Irvine Center Drive direct on-ramp and Bake Parkway off-ramp	B	B	B	C	B	C	B	C	B	C	B	C

Notes:
(1) HOV Lane LOS: LOS is based on v/c ratio using a capacity of 2,200 vph.
(2) GP and Auxiliary (AUX) lanes LOS: LOS is based on density (pc/mi/ln).
Bold indicates LOS exceeds LOS criteria.

Source: Traffic Study, 2017.

Average Peak-Hour Speed, Vehicle Hours of Delay, and Cost of Delay

Table 2.1.6-20 summarizes the expected speeds of GP lanes and HOV lanes under Alternative 1 (No Build) and Alternative 3 in 2030 and 2050. As discussed previously, speeds are provided for an entire trip within the project limits from I-5 to SR-55, as well as speed for a trip within the area where Alternative 3 would provide an additional lane on the freeway mainline. An entire trip along the GP lanes within the project limits under Alternative 3 would be 4 to 12 mph higher in 2050 compared to Alternative 1 (No Build). The HOV speeds are expected to be similar compared to Alternative 1 (No Build). For a trip within the area where Alternative 3 would provide additional GP lanes, the GP lane speeds are expected to be 12 to 16 mph higher compared to Alternative 1 (No Build) conditions. The HOV speeds are expected to be either the same or slightly higher.

Table 2.1.6-20. Alternative 3 I-405 Freeway Mainline Average Speed (mph)

Peak Hour	Project Limits – I-5 to SR-55						Area of GP Lane Addition					
	Existing (Year 2015)		Opening Year 2030		Design Year 2050		Existing (Year 2015)		Opening Year 2030		Design Year 2050	
	HOV	GP	HOV	GP	HOV	GP	HOV	GP	HOV	GP	HOV	GP
Northbound I-405												
AM	50	47	58	52	57	48	56	45	56	56	54	53
PM	61	44	63	45	62	43	63	46	63	57	62	54
Southbound I-405												
AM	61	49	63	59	63	55	64	51	64	64	64	61
PM	56	38	60	54	60	50	60	45	60	59	59	57

Source: Traffic Study, 2017.

There would be approximately 6,400 and 9,200 vehicle hours of delay on I-405 within the study area on a typical weekday under 2030 and 2050 conditions, respectively. In 2030, there would be approximately 1.6 million vehicle hours of delay annually on the freeway, which represents an approximate $46 million annual cost of delay. Under year 2050 Alternative 3 conditions, there would be approximately 2.3 million vehicle hours of delay on I-405, which represents an approximate $65 million annual cost of delay. Compared to Alternative 1 (No Build) conditions, Alternative 3 would save approximately 1.3 million vehicle hours of delay and $36 million in delay costs annually in 2050.

Intersections

Alternative 3 assumes the completion of improvements at the arterial intersections included in Alternative 1 (No Build). The intersections analyzed for Alternative 3 conditions are the same intersections analyzed under Alternative 1 (No Build) and Alternative 2.

Among intersections within Caltrans jurisdiction, all study intersections are expected to operate at or above the LOS requirement.

For intersections under City of Irvine jurisdiction, the intersection of Jeffrey Road and Alton Parkway is expected to operate at LOS E during the AM and PM peak hour in 2030 and 2050. The intersection of Culver Drive and University Drive is expected to operate at LOS E during the PM peak hour in both 2030 and 2050. The remaining study intersections are expected to operate at or above the LOS requirement. Though these intersections operate at unacceptable LOS levels, the project decreases the d/c ratio compared to the same conditions under

Alternative 1 (No Build) conditions. As such, this is not considered a significant impact associated with Alternative 3. There are no significant impacts to the study intersections.

A summary of LOS for Opening Year 2030 and Design Year 2050 intersection LOS is provided in Table 2.1.6-21.

Table 2.1.6-21. Alternative 3 2030 and 2050 Intersection Level of Service Summary

#	Intersection Location	LOS Criterion	Agency Jurisdiction	Peak-Hour LOS							
				Opening Year 2030				Design Year 2050			
				Caltrans HCM – 2010		City of Irvine – ICU		Caltrans HCM – 2010		City of Irvine – ICU	
				AM	PM	AM	PM	AM	PM	AM	PM
1*	NB I-405/Fortune Drive (NS) & Entertainment/ Enterprise Drive (EW)	*	Caltrans	D	F	—	—	C	F	—	—
2	Irvine Center Drive (NS) & Entertainment/Enterprise Drive (EW)	E	Caltrans	B	C	—	—	A	C	—	—
3	Irvine Center Drive (NS) & SB I-405 (EW)	E	Caltrans	C	B	—	—	B	B	—	—
4	Irvine Center Drive (NS) & Research Drive (EW)	D	Irvine	—	—	A	A	—	—	A	A
5	Sand Canyon Avenue (NS) & Alton Parkway (EW)	D	Irvine	—	—	C	C	—	—	C	B
6	Sand Canyon Avenue (NS) & NB I-405 (EW)	E	Caltrans	B	B	—	—	A	A	—	—
7	Sand Canyon Avenue (NS) & SB I-405 (EW)	E	Caltrans	D	C	—	—	E	C	—	—
8	Sand Canyon Avenue (NS) & Quail Hill Parkway (EW)	D	Irvine	A	B	—	—	A	B	—	—
9	Jeffrey Road (NS) & Alton Parkway (EW)	D	Irvine	—	—	**E**	**E**	—	—	**E**	**E**
10	Jeffrey Road (NS) & Quail Creek (EW)	D	Irvine	—	—	C	C	—	—	D	C
11	Jeffrey Road/University Drive (NS) & NB I-405 (EW)	E	Caltrans	B	B	—	—	C	C	—	—
12	Jeffrey Road/University Drive (NS) & SB I-405 (EW)	E	Caltrans	A	A	—	—	B	A	—	—
13	Culver Drive (NS) & NB I-405 (EW)	E	Caltrans	B	E	—	—	D	E	—	—
14	Culver Drive (NS) & SB I-405 (EW)	E	Caltrans	C	C	—	—	C	C	—	—
15	Culver Drive (NS) & Michelson Drive (EW)	D	Irvine	—	—	B	C	—	—	B	D

Table 2.1.6-21. Alternative 3 2030 and 2050 Intersection Level of Service Summary

#	Intersection Location	LOS Criterion	Agency Jurisdiction	Peak-Hour LOS							
				Opening Year 2030				Design Year 2050			
				Caltrans HCM – 2010		City of Irvine – ICU		Caltrans HCM – 2010		City of Irvine – ICU	
				AM	PM	AM	PM	AM	PM	AM	PM
16	Culver Drive (NS) & University Drive (EW)	D	Irvine	—	—	C	**E**	—	—	C	**E**
17	Jamboree Road (NS) & Main Street (EW)	E	Irvine	—	—	C	D	—	—	C	D
18	Jamboree Road (NS) & NB I-405 (EW)	E	Caltrans	B	B	—	—	B	B	—	—
19	Jamboree Road (NS) & SB I-405 (EW)	E	Caltrans	D	C	—	—	E	C	—	—
20	Jamboree Road (NS) & Michelson Drive (EW)	E	Irvine	—	—	C	D	—	—	D	E
21	MacArthur Boulevard (NS) & Main Street (EW)	E	Irvine	—	—	B	C	—	—	C	C
22	MacArthur Boulevard (NS) & NB I-405 (EW)	E	Caltrans	C	B	—	—	B	B	—	—
23	MacArthur Boulevard (NS) & SB I-405 (EW)	E	Caltrans	C	B	—	—	D	C	—	—
24	MacArthur Boulevard (NS) & Michelson Drive (EW)	E	Irvine	—	—	C	D	—	—	C	D

Notes:

LOS – Level of Service; v/c – Volume-to-Capacity; d/c – Demand Volume-to-Capacity; (NS) – North-South Direction; (EW) – East-West Direction

Bold indicates LOS exceeds LOS criteria.

* Entertainment/Enterprise Drive and Fortune Drive are not designated highway arterials; thus, the criteria defined in Section 2.1.6.2 does not apply to this intersection.

Source: Traffic Study, 2017.

Arterial Segments

Arterial segment analysis was performed for Alternative 3. As shown in Table 2.1.6-22, the following arterial segments exceed the City of Irvine acceptable LOS in 2030 under Alternative 3 conditions:

- Jeffrey Road between Alton Parkway and Quail Creek Road
- Jeffrey Road between Quail Creek Road and NB I-405 ramps
- University Drive between SB I-405 ramps and Michelson Drive
- University Drive between Yale Avenue and Culver Drive
- Culver Drive between SB I-405 ramps and Michelson Drive

In 2050, the arterial segments above continue to exceed the City of Irvine acceptable LOS with the addition of another segment at:

- Sand Canyon Avenue between Alton Parkway and I-405 NB ramps

Table 2.1.6-22. Alternative 3 2030 and 2050 Arterial Segment Level of Service Summary

#	Arterial	From	To	LOS Criteria	Opening Year 2030 - LOS	Design Year 2050 - LOS	Exceeds Impact Threshold
1	Irvine Center Drive	I-405 SB ramps	Research Drive	D	<D	<D	No
2	Sand Canyon Avenue	Alton Parkway	I-405 NB ramps	D	<D	**>D**	No
3	Sand Canyon Avenue	I-405 SB ramps	Quail Hill Parkway	D	<D	<D	No
4	Alton Parkway	Jeffrey Road	Sand Canyon Avenue	D	<D	<D	No
5	Jeffrey Road	Alton Parkway	Quail Creek Road	D	**>D**	**>D**	No
6	Jeffrey Road	Quail Creek Road	I-405 NB ramps	D	**>D**	**>D**	No
7	University Drive	I-405 SB ramps	Michelson Drive	D	**>D**	**>D**	No
8	University Drive	Yale Avenue	Culver Drive	D	**>D**	**>D**	No
9	Culver Drive	I-405 SB ramps	Michelson Drive	D	**>D**	**>D**	No
10	Culver Drive	Michelson Drive	Sandburg	D	<D	<D	No
11	Culver Drive	Sandburg	University Drive	D	<D	<D	No
12	Jamboree Road	Main Street	I-405 NB ramps	E	<E	<E	No
13	Jamboree Road	I-405 SB ramps	Michelson Drive	E	<E	<E	No
14	MacArthur Boulevard	Main Street	I-405 NB ramps	E	<E	<E	No
15	MacArthur Boulevard	I-405 SB ramps	Michelson Drive	E	<E	<E	No

Notes:
LOS – Level of Service**; Bold** indicates LOS exceeds LOS criteria.

Source: Traffic Study, 2017.

An arterial traffic impact can be measured with the difference in the d/c ratio under the peak-hour segment analysis and whether this measurement is greater than or equal to 0.02 compared to the future no-build condition. Compared to the d/c ratios under same year Alternative 1 (No Build) conditions, Alternative 3 improvements do not meet this measurement criteria; therefore, there are no adverse impacts to the arterial segments under Alternative 3.

Build Alternative 2 (Preferred Alternative) and Build Alternative 3

Construction (Short-Term) Impacts

The project would temporarily affect motoring vehicular, bicycle, and pedestrian traffic during construction. The potential for traffic disruption would mostly exist where bridges would be built, at connections to existing road and highway facilities, and where ramp work would be done, including ramp closure work. The duration of construction travel-time delays could be expected to last from a few days to more than a year in various construction zones and may require motorists to adjust their schedules to accommodate longer travel times. Based on the temporary nature of the roadway closures, implementation of a TMP and public outreach program (see Measure T-1, described below in Section 2.1.6.4, Avoidance, Minimization, and/or Mitigation Measures) would minimize impacts related to increased travel time and distance during construction.

Although TCEs would be required during construction of various roadway segments, access in and out of any residential homes and local businesses would not be blocked, and obstructions would be minimized to the extent possible.

Potential construction-related traffic and circulation/pedestrian and bicycle impacts would be minimized through implementation of a comprehensive TMP. A Draft TMP for the project has been prepared in accordance with the Caltrans Guidelines Deputy Directive 60 (DD-60) to minimize motorist delays when performing work activities on the State Highway System. The TMP is designed to minimize traffic delays that may result from lane restrictions or closures during construction operations and move motorists, pedestrians, and bicyclists through work zones quickly and safely. In addition, activities requiring temporary closures would be limited to the late night early morning off-peak period, and any detour routes would be clearly established and marked for motorists. To ensure that existing lanes of traffic are maintained through construction of the project, a detailed construction staging plan would be created during the plans, specifications, and estimate (PS&E) phase.

The Final TMP, which would be prepared during the PS&E phase, would require minimization of construction-related effects on traffic and circulation/pedestrian and bicyclists by applying a variety of techniques, including public information, motorist information, incident

management, construction strategies, demand management, and alternate route strategies. During project construction, the Traffic Management Team would observe traffic conditions and make recommendations concerning any changes that need to be made with respect to traffic management. The TMP coordinator would work closely to develop timely recommendations to address traffic-related effects on traffic and circulation/pedestrian and bicyclists. The Final TMP would be prepared prior to project construction and would address traffic detours for roadway closures during construction. The Final TMP would also avoid and minimize construction-related traffic and circulation effects of the proposed project.

2.1.6.4 Avoidance, Minimization, and/or Mitigation Measures

No permanent adverse effects to traffic and circulation are anticipated due to the project. Temporary adverse effects due to construction-related activities are anticipated. The following avoidance, minimization, and/or mitigation measures will be implemented with the project and will minimize or avoid impacts related to traffic and transportation impacts. Standardized measures which are employed on most, if not all, Caltrans projects are indicated in bold.

T-1: A Final TMP will be prepared prior to project construction that identifies methods to avoid and minimize construction-related traffic and circulation effects and minimize impacts to pedestrian and bicycle access, including ADA-compliant features, as a result of the proposed project. Elements in the Final TMP to minimize construction-related effects on traffic and circulation shall include a variety of techniques, including public information, motorist information, incident management, construction strategies, demand management, and alternate route strategies. During construction, the Contractor shall implement the methods identified in the Final TMP.